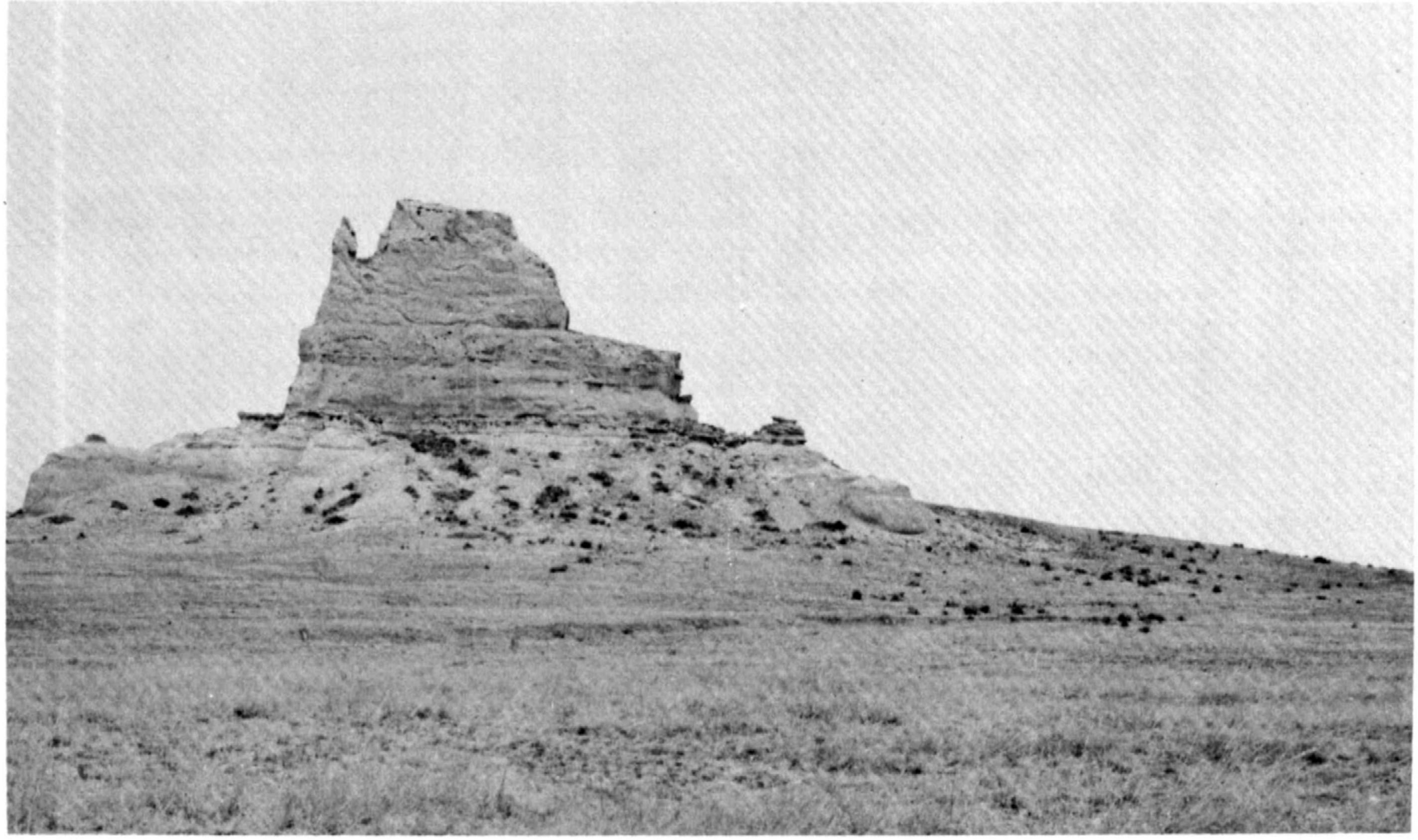
SOIL SURVEY OF

Goshen County, Wyoming

Northern Part



United States Department of Agriculture
Soil Conservation Service
in cooperation with
Wyoming Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1957–1973. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1974. This survey was made cooperatively by the Soil Conservation Service and the Wyoming Agricultural Experiment Station. It is part of the technical assistance furnished to the Lingle-Fort Laramie Conservation District and the North Platte Valley Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms, ranches, woodlands, and wildlife areas; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Goshen County, Wyoming, Northern Part, are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil.

Finding and Using Information

The "Guide to mapping units" lists all the soils of the survey area in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the windbreak site and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers can learn about use and management of the soils from the soil descriptions and from the discussion of the range sites and windbreak sites.

Foresters can refer to the section "Windbreaks" where the soils of the survey area are grouped according to their suitability for trees.

Wildlife managers can find information about soils and wildlife in the section "Wildlife."

Ranchers can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists especially may be interested in the section "Formation and classification of the soils."

Newcomers in the area may be interested in the section "General soil map," where broad patterns of soils are described and in the section "General nature of the area."

***Cover:* Tea Kettle Rock, a well-known landmark in Goshen County, formed from Arikaree sandstone. The soils in the foreground are Valent-Dwyer loamy fine sands.**

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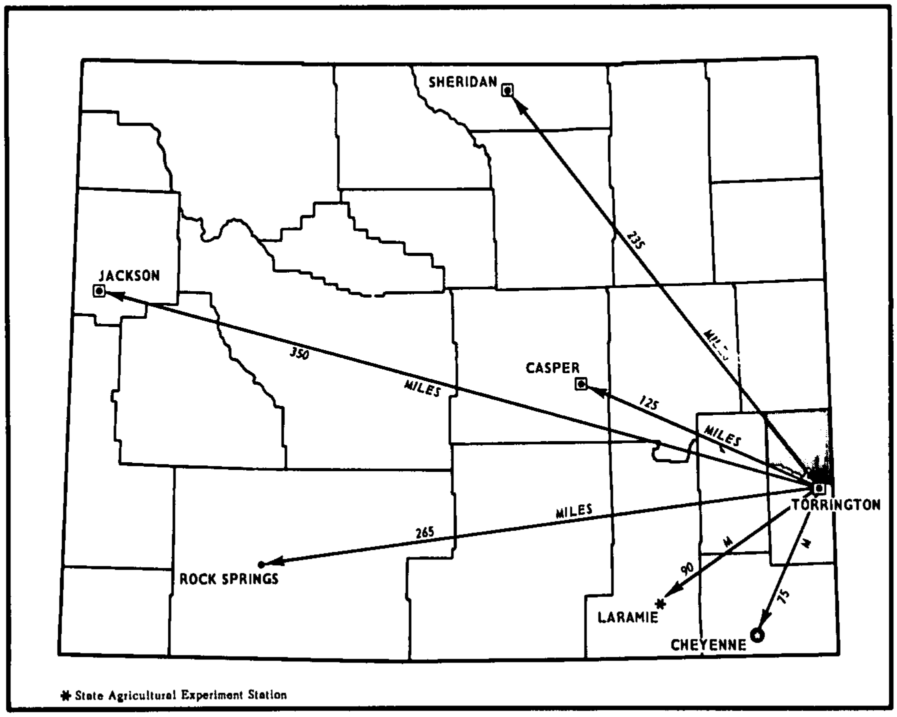

Location of Goshen County, Northern Part, in Wyoming.

SOIL SURVEY OF GOSHEN COUNTY, WYOMING, NORTHERN PART

By Frank L. Nelson, Fraser Stephens, and Halvor B. Ravenholt, Soil Conservation Service[1]

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Wyoming Agricultural Experiment Station

GOSHEN COUNTY, NORTHERN PART, is in southeastern Wyoming. It has a total area of 607,477 acres, or about 949 square miles. Torrington, the largest town, is the county seat of Goshen County.

The survey area is in the High Plains section of the Great Plains province and is drained by the North Platte River and its tributaries.

Elevation in the northern part of Goshen County ranges from 4,200 to 6,135 feet. The mean annual air temperature ranges from 45.5° to 48° F. The frost-free season ranges from 127 to 155 days. Precipitation ranges from 12.5 to 15 inches. About half of the precipitation occurs during the frost-free season.

Most of the survey area is used for the production of livestock. Many cattle and sheep are sold for fattening in the irrigated area just outside the survey area. Sugar beets, corn, beans, potatoes, and alfalfa are the principal irrigated crops. Winter wheat is the principal dryland crop.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the area, where they are located, and how they can be used. The soil scientists went into the survey area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has been changed very little by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey (*7*).[2]

Soils that have a profile almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. Jayem and Wendover, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Mitchell loam, 0 to 6 percent slopes, is one of several phases within the Mitchell series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. The photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map in the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some other kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series or of different phases within one series. Such mapping units are called soil complex, soil association, or undifferentiated group. Several soil complexes have been mapped in Goshen County, Northern Part.

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Satanta-Noden complex, 0 to 6 percent slopes, is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called miscellaneous areas and are given descriptive names. Dune land is an example.

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[1] Others who contributed to the survey are PAUL J. LUPCHO and HOWARD E. MCCOMAS. ARVAD J. CLINE and CLARENCE J. FOWKES assisted in the field correlation. All are soil scientists with the Soil Conservation Service or soil scientists formerly with the Soil Conservation Service.

[2] Italicized numbers in parentheses refer to "References," p. 61.

While a soil survey is in progress, samples of soils are taken, as needed, for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

But only part of the soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

The soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

General soil map

The general soil map at the back of this survey shows, in color, the soil associations in the northern part of Goshen County. A soil association is a unique natural landscape that has a distinct pattern of soils and of relief and drainage. Typically, a soil association consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in an association can occur in other associations but in different patterns.

A map showing soil associations is useful to people who want a general idea of the soils in a survey area, who want to compare different parts of that area, or who want to find suitable sites for a certain kind of land use. Such a map is a useful general guide for broad planning of a watershed, a wooded tract, or a wildlife area or for broad planning of recreation facilities, community developments, and engineering works. It is not a suitable map for planning the management of a farm or field or for selecting a site for a road or building or other structure, because the soils within an association ordinarily vary in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in this survey area have been grouped into general kinds of landscapes for broad interpretative purposes. Each of the broad groups and the soil associations in it are described on the following pages.

Nearly level to steep, shallow to deep, well drained to excessively drained soils on uplands

1. Jayem-Manter-Alice association

Deep, nearly level to sloping, well drained loamy soils that formed in eolian deposits and in material weathered from sandstone

This association consists of deep fine sandy loams and sandy loams. It is mainly north of Prairie Center and in a band running south for approximately 18 miles. It is also north and west of the big loop in the Interstate Canal and in a small area west of Pine Ridge. The elevation ranges from 4,450 to 4,950 feet. Vegetation is dominantly needleandthread, blue grama, and threadleaf sedge.

This association makes up about 14 percent of the survey area. Jayem soils make up about 46 percent of the association, Manter soils about 18 percent, and Alice soils about 12 percent. Ascalon, Embry, Otero and Vetal soils make up the rest.

Jayem soils have a surface layer of grayish brown fine sandy loam, a subsoil of brown fine sandy loam, and a substratum of light brownish gray fine sandy loam. Manter soils have a surface layer of brown sandy loam, a subsoil of dark grayish brown sandy loam, and a substratum of brown and light brownish gray fine sandy loam. Alice soils have a surface layer of grayish brown and brown fine sandy loam. The underlying material is light brownish gray and very pale brown fine sandy loam.

About 80 percent of this association is used as rangeland, 10 percent for irrigated crops, and 8 percent for dryland crops. About 2 percent of the association consists of roads and farmsteads.

2. Satanta-Noden-Rosebud association

Deep and moderately deep, nearly level to sloping, well drained loamy soils that formed in eolian deposits and in material weathered from sandstone

This association consists of deep and moderately deep fine sandy loams and sandy loams. It is north of Prairie Center along the Niobrara County line, in a narrow band south and east of Prairie Center, and in an irregularly shaped area north of Casebier Hill and south of Muskrat Creek. The elevation ranges from 4,750 to 5,000 feet. The dominant vegetation is western wheatgrass, needleandthread, blue grama, and threadleaf sedge.

This association makes up about 6 percent of the survey area. Satanta soils make up about 38 percent of the association, Noden soils about 26 percent, and Rosebud soils about 20 percent. Hargreave, Lambman, and Trelona soils make up the rest.

Satanta soils have a surface layer of dark grayish brown fine sandy loam. The upper part of the subsoil is dark grayish brown loam, the middle part is brown clay loam, and the lower part is pale brown loam. The substratum is light brownish gray loam. Noden soils have a surface layer of dark grayish brown sandy loam. The upper part of the subsoil is dark grayish brown sandy loam, the middle part is brown sandy clay loam, and the lower part is pale brown sandy loam. The substratum is pale brown fine sandy loam. Rosebud soils have a surface layer of dark grayish brown fine sandy loam. The subsoil is brown sandy clay loam, and the substratum is pale brown fine sandy loam. Calcareous sandstone is at a depth of 20 to 40 inches.

About 73 percent of this association is used as rangeland, 20 percent for dryland crops, and 5 percent for irrigated crops. Roads and farmsteads make up the rest of the association.

3. Jayem-Manter-Trelona association

Deep and shallow, nearly level to moderately steep, well drained loamy soils that formed in eolian deposits and in material weathered from sandstone

This association consists of deep and shallow fine sandy loams and sandy loams. It is in the Spoon Butte area, north of Lone Sand Hill, in the Pine Ridge area and north to the Niobrara County line, on Casebier Hill, in the lower part of Cottonwood Draw, and east of Jay Em in the Red Cloud Slough area. The elevation ranges from 4,300 to 4,950 feet. The dominant vegetation is needleandthread, blue grama, and threadleaf sedge.

This association makes up about 22 percent of the survey area. Jayem soils make up about 30 percent of the association, Manter soils about 20 percent, and Trelona soils about 20 percent. The rest consists mainly of Alice, Lambman, and Noden soils and areas of Rock outcrop-Tassel complex, Sandstone outcrop, and Torriorthents, gullied.

Jayem soils have a surface layer of grayish brown fine sandy loam, a subsoil of brown fine sandy loam, and a substratum of light brownish gray fine sandy loam. Manter soils have a surface layer of brown sandy loam, a subsoil of dark grayish brown sandy loam, and a substratum of brown and light brownish gray fine sandy loam. Trelona soils have a surface layer of dark grayish brown fine sandy loam. The underlying material is brown fine sandy loam. Sandstone is at a depth of 10 to 20 inches.

About 90 percent of this association is used as rangeland, 5 percent for dryland crops, and 3 percent for irrigated crops. Roads and farmsteads make up the rest of the association.

4. Satanta-Rosebud-Lambman association

Deep to shallow, nearly level to moderately steep, well drained loamy soils that formed in eolian deposits and in material weathered from sandstone

This association consists of deep, moderately deep, and shallow fine sandy loams. It is east of Rawhide Mountain and extends about 10 miles south from the Niobrara County line. The elevation ranges from 4,850 to 5,000 feet. The dominant vegetation is western wheatgrass, blue grama, threadleaf sedge, and needleandthread.

This association makes up about 4 percent of the survey area. Satanta soils make up about 35 percent of the association, Rosebud soils about 25 percent, and Lambman soils about 20 percent. Willowman, Brownrigg, and Trelona soils make up the rest.

Satanta soils have a surface layer of dark grayish brown fine sandy loam, and a subsoil that is dark grayish brown loam in the upper part, brown clay loam in the middle part, and pale brown loam in the lower part. The substratum is light brownish gray loam. Rosebud soils have a surface layer of dark grayish brown fine sandy loam, a subsoil of brown sandy clay loam, and a substratum of pale brown fine sandy loam over sandstone at a depth of 20 to 40 inches. Lambman soils have a surface layer of dark grayish brown loam, and a subsoil of brown clay loam and loam over sandstone at a depth of 10 to 20 inches.

About 90 percent of this association is used as rangeland, 5 percent for dry cropland, and 3 percent for irrigated crops. Roads and homesteads make up the rest of the association.

5. Valent-Dwyer association

Deep, nearly level to steep, excessively drained sandy soils that formed in eolian deposits

This association consists of deep fine sand and loamy fine sand. It is in the southeastern part of the survey area, just north of the Interstate Canal.

A narrow band of this association follows the Interstate to Fort Laramie and extends a few miles north beyond the Fort. It is in the Sage Creek area east and west of Highway 85, around Lone Sand Hill and the northeastern part of the survey area, northwest and northeast of Prairie Center. The elevation ranges from 4,350 to 4,950 feet. The dominant vegetation is prairie sandreed, needleandthread, and blue grama.

This association makes up about 23 percent of the survey area. Valent soils make up about 40 percent of the association and Dwyer soils make up about 35 percent. Dailey, Tassel, Dune land, Embry, and Alice soils make up the rest.

Valent soils have a surface layer of grayish brown fine sand over a layer of brown fine sand. The underlying material is pale brown fine sand. Dwyer soils have a surface layer of light brownish gray loamy fine sand over pale brown loamy fine sand. The underlying material is very pale brown loamy fine sand.

About 93 percent of this association is used as rangeland, and about 5 percent for irrigated crops. Roads and homesteads make up the rest of the association.

6. Mitchell-Bordeaux-Epping association

Deep and shallow, nearly level to moderately steep, well drained loamy soils that formed mainly in sediment that was derived from siltstone

This association consists of deep and shallow loams and fine sandy loams. It is in the Chestnut Valley from the Nebraska line to Rawhide Creek, and west of lower Cottonwood Draw near the Platte County line. The elevation ranges from 4,350 to 4,750 feet. The dominant vegetation is blue grama, needleandthread, western wheatgrass, and threadleaf sedge.

This association makes up about 4 percent of the survey area. Mitchell soils make up about 50 percent of the association, Bordeaux soils about 20 percent, and Epping soils about 10 percent. Keota, Otero, and Alice soils make up the rest.

Mitchell soils have a surface layer of brown loam over a layer of grayish brown loam. The underlying material is brown and light brownish gray loam. Bordeaux soils have a surface layer of brown fine sandy loam. The underlying material is light brownish gray fine sandy loam and very pale brown loam. Epping soils have a surface layer of pale brown loam. The underlying material is very pale brown loam underlain by siltstone at a depth of 10 to 20 inches.

About 83 percent of the association is used as rangeland, and about 15 percent for dryland crops. Roads and homesteads make up the rest of the association.

7. Featherlegs-Wolf association

Deep, nearly level to hilly, well drained loamy soils that formed in alluvial and colluvial sediment

This association consists of deep loam soils. It is in the northwest part of the survey area, around Rawhide Butte, beginning at the Niobrara County line and extending south to Haystack Range and Carnate Hill. The elevation ranges from 4,700 to 5,200 feet. The dominant vegetation is western wheatgrass, blue grama, threadleaf sedge, and Sandberg bluegrass.

This association makes up about 8 percent of the survey area. Featherlegs soils make up about 40 percent of the association and Wolf soils make up about 35 percent. Brownrigg, Albinas, Lambman, and Willowman soils make up the rest.

Featherlegs soils have a surface layer of dark grayish brown loam, a subsoil of brown and light brownish gray clay loam, and a substratum of light brownish gray loam over light brownish gray very gravelly sandy loam. Wolf soils have a surface layer of dark grayish brown loam, a subsoil of brown and light brownish gray clay loam, and a substratum of light gray clay loam over very gravelly sandy loam.

About 83 percent of the association is used as rangeland, and about 15 percent for dryland crops. Roads and homesteads make up the rest of the association.

8. Wendover-Motoqua-Rock outcrop association

Shallow, moderately steep and steep, well drained loamy soils that formed in material weathered from granite, limestone and sandstone, and outcrops of granite, limestone and sandstone

This association consists of shallow loams and sandy loams and Rock outcrop. It extends along the western edge of the survey area from the Haystack Range northward along the Platte County line to the Niobrara County line and includes Rawhide Mountain. The elevation ranges from 4,800 to 6,150 feet. The dominant vegetation is bluestem, blue grama, western wheatgrass, sideoats grama, threadleaf sedge, mountain mahogany, scattered juniper, and ponderosa pine.

This association makes up about 13 percent of the survey area. Wendover soils make up about 35 percent of the association, Motoqua soils about 25 percent, and Rock outcrop about 25 percent. Tassel, Willowman, Brownrigg, and Albinas soils make up the rest.

Wendover soils have a surface layer of dark grayish brown very gravelly fine sandy loam, a subsoil of dark grayish brown very gravelly loam, and a substratum of very pale brown very gravelly sandy loam underlain by limestone at a depth of 7 to 20 inches. Motoqua soils have a surface layer of dark gray very gravelly loam and a subsoil of dark brown very gravelly clay loam underlain by granite bedrock at a depth of 8 to 20 inches. Rock outcrops are exposures of sandstone, granite, or limestone bedrock.

About 99 percent of this association is used as rangeland. Roads and trails make up the rest of the association.

Nearly level to steep, deep, excessively drained to poorly drained soils on flood plains, fans, terraces, tablelands, and uplands

9. Torrifluvents-Fluvaquents-Torriorthents association

Nearly level to sloping, well drained to poorly drained loamy and sandy soils that formed in alluvial deposits on flood plains and uplands

This association consists of deep loamy, sandy, or gravelly soils. This association is in the center of the survey area along Rawhide Creek and its major tributaries. The elevation ranges from 4,300 to 4,500 feet. The dominant vegetation is basin wildrye, switchgrass, needleandthread, prairie sandreed, alkali sacaton, inland saltgrass, and western wheatgrass.

This association makes up about 4 percent of the survey area. Torrifluvents make up about 40 percent of the association, Fluvaquents about 25 percent, and Torriorthents about 20 percent. Alice, Embry, Vetal, and Epping soils make up the rest.

Torrifluvents occasionally flood for short periods. They may be strongly alkaline, saline, or calcareous. Textures vary from coarse to moderately fine. Fluvaquents have coarse to moderately fine strata and fluctuating water tables that may be saline. Torriorthents are deep to moderately deep, friable soils with little or no development. Because they are located where runoff water collects, they erode easily.

About 49 percent of this association is used as rangeland, about 30 percent for irrigated crops, and 20 percent for dryland crops. Roads and trails make up the rest of the association.

10. Dix-Alice association

Nearly level to steep, well drained and excessively drained, gravelly and nongravelly loamy soils that formed in alluvial deposits on fans, terraces, and tablelands

This association consists of deep gravelly sandy loams and fine sandy loams. It is between Fort Laramie and the big loop of the Interstate Canal and breaks into the North Platte River Valley. The elevation ranges from 4,300 to 4,400 feet. The dominant vegetation is blue grama, needleandthread, threadleaf sedge, Indian ricegrass, and western wheatgrass.

This association makes up about 2 percent of the survey area. Dix soils make up about 55 percent of the association and Alice soils about 25 percent. Epping, Manter, Otero, and Trelona soils make up the rest.

Dix soils have a surface layer of brown gravelly sandy loam over a layer of brown very gravelly sandy loam. The underlying material is pale brown very gravelly sandy loam. Sand and gravel are at a depth of 12 to 18 inches. Alice soils have a surface layer of grayish brown and brown fine sandy loam. The underlying material is light brownish gray and very pale brown fine sandy loam.

About 98 percent of this association is used as rangeland. Roads and homesteads make up the rest of the association.

Description of the soils

This section describes each soil series in detail and then, briefly, each mapping unit in that series. Unless stated otherwise, what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface down to rock or other underlying material. The profile of each series is described twice. The first description is brief and in terms familiar to a layman. The second is more detailed and is for those who need to make thorough and precise studies of soils. The profile described is representative of mapping units in a series. If the profile of a given mapping unit is different from the one described for the series, the differences are apparent in the name of the mapping unit, or the differences are stated in describing the mapping unit. Color terms are for moist soil unless otherwise stated.

As mentioned in the section "How this survey was made," not all mapping units are members of a soil series. Sandstone outcrop, for example, does not belong to a soil series. Nevertheless, it is listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, and windbreak group in which the mapping unit has been placed. The "Guide to mapping units" at the back of this survey also shows the capability unit, range site, and windbreak group in which each soil has been placed.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (7).

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Albinas loam, 0 to 6 percent slopes	6,504	1.1
Alice fine sandy loam, 0 to 6 percent slopes	7,588	1.2
Alice fine sandy loam, 6 to 10 percent slopes	3,869	.6
Bordeaux fine sandy loam, 0 to 3 percent slopes	1,268	.2
Bordeaux fine sandy loam, 3 to 10 percent slopes	3,826	.6
Brownrigg-Featherlegs-Wolf complex, 10 to 40 percent slopes	18,683	3.1
Dailey-Valent loamy fine sands, 0 to 3 percent slopes	16,361	2.7
Dailey-Valent loamy fine sands, 3 to 10 percent slopes	24,702	4.1
Dix-Alice complex, 0 to 10 percent slopes	1,028	.2
Dix-Alice complex, 10 to 40 percent slopes	10,024	1.7
Dune land	1,645	.3
Dwyer-Valent-Tassel complex, 3 to 20 percent slopes	30,938	5.0
Embry fine sandy loam, 0 to 3 percent slopes	370	.1
Embry fine sandy loam, 3 to 10 percent slopes	2,124	.3
Epping loam, 0 to 10 percent slopes	854	.1
Featherlegs-Wolf loams, 0 to 6 percent slopes	16,882	2.8
Featherlegs-Wolf loams, 6 to 10 percent slopes	2,245	.4
Featherlegs-Wolf-Brownrigg complex, 3 to 10 percent slopes	8,543	1.4
Hargreave-Noden sandy loams, 0 to 6 percent slopes	3,716	.6
Hargreave-Noden sandy loams, 6 to 10 percent slopes	990	.2
Jayem fine sandy loam, 0 to 3 percent slopes	17,939	3.0
Jayem fine sandy loam, 3 to 10 percent slopes	27,395	4.5
Jayem-Ascalon-Manter complex, 3 to 10 percent slopes	55,276	9.0
Jayem-Trelona-Manter complex, 3 to 20 percent slopes	70,292	11.4
Keota loam, 0 to 6 percent slopes	628	.1
Keota-Epping loams, 6 to 10 percent slopes	983	0.2
Mitchell loam, 0 to 6 percent slopes	8,260	1.4
Mitchell loam, 6 to 10 percent slopes	6,249	1.0
Mitchell loam, 10 to 20 percent slopes	1,731	.3
Motoqua-Rock outcrop complex, 20 to 60 percent slopes	7,731	1.3
Otero fine sandy loam, 0 to 6 percent slopes	9,507	1.6
Otero fine sandy loam, 6 to 10 percent slopes	4,814	.8
Rock outcrop-Tassel complex	29,017	4.8
Rosebud-Hargreave fine sandy loams, 0 to 6 percent slopes	6,108	1.0
Rosebud-Hargreave fine sandy loams, 6 to 10 percent slopes	3,088	.5
Rosebud-Trelona fine sandy loams, 0 to 6 percent slopes	3,368	.6
Rosebud-Trelona fine sandy loams, 6 to 10 percent slopes	5,536	.9
Rosebud-Trelona fine sandy loams, 10 to 20 percent slopes	355	.1
Sandstone outcrop	13,652	2.2
Satanta-Noden complex, 0 to 6 percent slopes	18,366	3.0
Satanta-Noden complex, 6 to 10 percent slopes	2,784	.5
Satanta-Willowman-Lambman complex, 3 to 20 percent slopes	11,267	1.9
Torrifluvents-Fluvaquents complex	1,723	.3
Torrifluvents-Fluvaquents complex, saline	8,411	1.4
Torriorthents, gullied	14,035	2.3
Ustic Torrifluvents, undulating	3,862	.6
Valent-Dwyer fine sands, rolling	20,001	3.3
Valent-Dwyer fine sands, hilly	14,536	2.4
Valent-Dwyer loamy fine sands, 0 to 3 percent slopes	6,883	1.1
Valent-Dwyer loamy fine sands, 3 to 10 percent slopes	26,778	4.4
Vetal fine sandy loam, 0 to 6 percent slopes	17,846	2.9
Vetal fine sandy loam, 6 to 10 percent slopes	1,019	.2
Wendover-Rock outcrop complex, 10 to 60 percent slopes	25,877	4.3
Total	607,477	100.0

Albinas series

The Albinas series consists of deep, well drained, nearly level to gently sloping soils on alluvial fans and valley-filling side slopes. These soils formed in materials that weathered from a variety of parent materials that were locally transported. Slopes are 0 to 6 percent. The vegetation is blue grama, green needlegrass, needleandthread, western wheatgrass, and fringe sage.

In a representative profile, the surface layer is dark brown and dark grayish brown loam and fine sandy loam 15 inches thick. The subsoil is dark brown and grayish brown clay loam 23 inches thick. The substratum is brown, calcareous loam.

These soils are moderately permeable. The available water capacity is 9.5 to 10.5 inches. The effective rooting depth is 60 inches or more. These soils are used as range and for dryland crops, irrigated crops, windbreaks, and wildlife food and cover.

A representative profile of Albinas loam, 0 to 6 percent slopes, 1,850 feet south and 2,310 feet east of the northwest corner of sec. 4, T. 30 N., R. 63 W.

A11—0 to 7 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; abundant very fine roots; mildly alkaline; clear smooth boundary.

A12—7 to 15 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common very fine pores; mildly alkaline; clear smooth boundary.

B2t—15 to 25 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; strong medium and coarse prismatic structure parting to strong medium and coarse subangular blocky; hard, friable, sticky and plastic; many moderately thick clay films on peds; many micro and very fine pores; mildly alkaline; abrupt wavy boundary.

B3t—25 to 38 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate medium and coarse prismatic structure parting to moderate medium and coarse subangular blocky; hard, friable, sticky and plastic; common thin clay films on peds; streaks of lime in pores and on peds; mildly alkaline; abrupt smooth boundary.

Cca—38 to 60 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The depth to calcareous material ranges from 25 to 30 inches. The A horizon has value of 4 or 5 dry and 2 or 3 moist; it has chroma of 2 or 3. Texture is loam or fine sandy loam. It has granular structure in most places and subangular blocky structure in some places. The Bt horizon has value of 4 or 5 dry, and 3 or 4 moist; it has chroma of 2 or 3. Reaction ranges from neutral to mildly alkaline. The Cca horizon has value of 5 to 7 dry and 4 to 6 moist. The texture is loam or fine sandy loam, and the calcium carbonate content ranges from 5 to 15 percent. It is moderately to strongly alkaline.

1B—Albinas loam, 0 to 6 percent slopes. This nearly level to gently sloping soil is on alluvial fans and valley-filling side slopes. Included in mapping are areas of Rosebud fine sandy loam, Satanta fine sandy loam, and Vetal fine sandy loam, that make up about 10 percent of the acreage.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is moderate.

This soil is used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover.

Capability unit IIIe–2, dryland; IIe–2, irrigated; Loamy range site; Silty to clayey windbreak site.

Alice series

The Alice series consists of deep, well drained, nearly level to rolling soils on dissected tablelands. These soils formed in alluvial and wind-deposited material that originated from calcareous sandstone. Slopes are 0 to 10 percent. The vegetation is blue grama, needleandthread, threadleaf sedge, Indian ricegrass, and western wheatgrass.

In a representative profile the surface layer is grayish brown and brown fine sandy loam 10 inches thick. The underlying material is light brownish gray and very pale brown calcareous fine sandy loam.

These soils have moderately rapid permeability. The available water capacity is 7.8 to 9.0 inches. The effective rooting depth is 60 inches or more.

These soils are used for irrigated and dryland crops. They are also used as range and for windbreaks and wildlife food and cover.

A representative profile of Alice fine sandy loam, 0 to 6 percent slopes, 2,110 feet north and 530 feet east of the southwest corner of sec. 33, T. 26 N., R. 60 W.

A11—0 to 2 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

A12—2 to 10 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

C1ca—10 to 24 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline; gradual wavy boundary.

C2ca—24 to 60 inches; very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline.

The depth to calcareous material ranges from 10 to 20 inches. The gravel content ranges from 0 to 15 percent. The A horizon has value of 4 or 5 dry and 2 or 3 moist. The texture ranges from fine sandy loam to loam. The C horizon has value of 5 to 7 dry and 4 to 6 moist; it has chroma of 2 to 4. It is moderately to strongly alkaline, and the texture ranges from fine sandy loam to sandy loam.

2B—Alice fine sandy loam, 0 to 6 percent slopes. This nearly level to undulating soil is in drainageways and on foot slopes and fans. It has the profile described as representative of the series. Included in mapping and making up about 10 percent of the acreage are small areas of Bordeaux fine sandy loam, Jayem fine sandy loam, Otero fine sandy loam, and Vetal fine sandy loam.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is severe.

This soil is used for irrigated and dryland crops. It is also used as range and for windbreaks and wildlife food and cover. Capability unit IIIe–5, dryland; IIe–5, irrigated; Sandy range site; Sandy windbreak site.

2C—Alice fine sandy loam, 6 to 10 percent slopes. This rolling soil is on dissected terraces and colluvial-alluvial foot slopes and fans. It has a profile similar to the one described as representative of the series. Included in mapping and making up about 10 percent of the acreage are small areas of Bordeaux fine sandy loam, Epping loam, Jayem fine sandy loam, Otero fine sandy loam, and Trelona fine sandy loam.

Runoff is medium. The hazard of erosion is moderate, and the hazard of soil blowing is severe.

This soil is used for irrigated and dryland crops. It is also used as range and for windbreaks and wildlife food and cover. Capability unit IVe–5, dryland; IIIe–5, irrigated; Sandy range site; Sandy windbreak site.

Ascalon series

The Ascalon series consists of deep, well drained, undulating to rolling soils on dissected tablelands. These soils formed in eolian sand and in material weathered from calcareous sandstone. Slopes are 3 to 10 percent. The vegetation is blue grama, needleandthread, threadleaf sedge, green needlegrass, and western wheatgrass.

In a representative profile the surface layer is grayish brown fine sandy loam 6 inches thick. The subsoil is brown and pale brown sandy clay loam 14 inches thick. The substratum is light gray sandy loam.

These soils are moderately permeable. The available water capacity is 7.1 to 8.3 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for dryland crops, windbreaks, and wildlife food and cover.

A representative profile of Ascalon fine sandy loam, in an area of Jayem-Ascalon-Manter complex, 3 to 10 percent slopes, 1,805 feet west of the northeast corner of sec. 33, T. 27 N., R. 61 W.

A1—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam; very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to weak fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B2t—6 to 13 inches; brown (10YR 5/3) sandy clay loam; very dark grayish brown (10YR 3/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; common moderately thick clay films between mineral grains; common micro and very fine pores; mildly alkaline; clear smooth boundary.

B3ca—13 to 20 inches; pale brown (10YR 6/3) sandy clay loam; brown (10YR 5/3) moist; weak fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; few thin clay films between mineral grains; common micro and very fine pores; slightly effervescent; moderately alkaline; gradual wavy boundary.

C1ca—20 to 31 inches; light gray (10YR 7/2) sandy loam; grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; common micro and very fine pores; violent effervescence; moderately alkaline; diffuse smooth boundary.

C2ca—31 to 60 inches; light gray (10YR 7/2) sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; violent effervescence; moderately alkaline.

The depth to calcareous material ranges from 11 to 24 inches. The thickness of the solum ranges from 15 to 24 inches. The A horizon has value of 4 or 5 when dry and chroma of 2 or 3. The texture ranges from loamy very fine sand to very fine sandy loam. The B horizon has value of 3 to 5 when moist and chroma of 2 to 4. The B horizon can be calcareous in the lower part. The C horizon has value of 6 or 7 when dry and chroma of 2 or 3. It is loamy fine sand to fine sandy loam.

Ascalon soils are mapped only with Jayem and Manter soils.

Bordeaux series

The Bordeaux series consists of deep, well drained, nearly level to rolling soils on dissected terraces. These soils formed in eolian material that is underlain by sediment that was derived from siltstone. Slopes are 0 to 10 percent. The vegetation is blue grama, needleandthread and western wheatgrass.

In a representative profile the surface layer is brown fine sandy loam 8 inches thick. The underlying material to a depth of 20 inches is light brownish gray calcareous fine sandy loam. Below this, it is very pale brown calcareous loam.

These soils have moderate to moderately rapid permeability. The available water capacity is 9.0 to 10.2 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for dryland crops, windbreaks, and wildlife food and cover.

A representative profile of Bordeaux fine sandy loam, 0 to 3 percent slopes, 2,275 feet south and 1,650 feet east of the northwest corner of sec. 5, T. 26 N., R. 60 W.

A1—0 to 8 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

C1ca—8 to 20 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak coarse prismatic structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

IIC2ca—20 to 60 inches; very pale brown (10YR 7/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; a few coarse fragments of Brule siltstone; strongly calcareous; moderately alkaline.

The depth to calcareous material is 6 to 19 inches. The A horizon has value of 4 or 5 dry and 2 or 3 moist; it has chroma of 2 or 3. The texture is very fine sandy loam to fine sandy loam. The C1ca horizon has value of 5 or 6 dry and 3 or 4 moist; it has chroma of 2 or 3. The C2ca horizon has value of 6 or 7 dry and 5 or 6 moist; it has chroma of 2 or 3. It is very fine sandy loam to loam and moderately alkaline to strongly alkaline.

3A—Bordeaux fine sandy loam, 0 to 3 percent slopes. This nearly level soil is on dissected terraces. It has the profile described as representative of the series. Included in mapping and making up about 10 percent of the total acreage are small areas of Alice fine sandy loam, Jayem fine sandy loam, Keota loam, Mitchell loam, Otero fine sandy loam, and Vetal fine sandy loam.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is severe.

This soil is used as range and for dryland crops, windbreaks, and wildlife food and cover. Capability unit IIIe-5, dryland; Sandy range site; Sandy windbreak site.

3C—Bordeaux fine sandy loam, 3 to 10 percent slopes. This undulating to rolling soil is on dissected terraces. Small areas of Alice fine sandy loam, Jayem fine sandy loam, Keota loam, Mitchell loam, Otero fine sandy loam, and Trelona fine sandy loam are included in mapping and make up about 10 percent of the acreage.

This soil is used as range and for dryland crops, windbreaks, and wildlife food and cover. Capability unit IVe-5, dryland; Sandy range site; Sandy windbreak site.

Brownrigg series

The Brownrigg series consists of shallow, well drained, gently undulating to steep soils on dissected pediments and toe slopes. These soils formed in colluvium and outwash over calcareous sandstone. Slopes are 3 to 40 percent. The vegetation is blue grama, threadleaf sedge, bluestem, prairie threeawn, western wheatgrass, needleandthread, yucca, cactus, and scattered ponderosa pine and juniper.

In a representative profile the surface layer is dark grayish brown very cobbly loam 3 inches thick. The subsoil is dark brown very gravelly clay loam 5 inches thick. The substratum is brown very gravelly loam that is underlain by calcareous sandstone at a depth of about 15 inches.

These soils have moderately rapid permeability. The available water capacity is 1.3 to 1.5 inches. The effective rooting depth is 11 to 20 inches.

These soils are used as range and for wildlife food and cover.

A representative profile of Brownrigg very cobbly loam, in an area of Brownrigg-Featherlegs-Wolf complex, 10 to 40 percent slopes, 760 feet west and 1,090 feet north of the southeast corner of sec. 1, T. 27 N., R. 65 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 50 percent gravel, cobbles, and stones; mildly alkaline; clear smooth boundary.

B2t—3 to 8 inches; dark brown (10YR 4/3) very gravelly clay loam, dark brown (10YR 3/3) moist; strong very fine and fine subangular blocky structure; hard, firm, sticky and plastic; many moderately thick clay films; 50 percent gravel, cobbles, and stones; mildly alkaline; clear smooth boundary.

C1ca—8 to 15 inches; brown (10YR 5/3) very gravelly loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 65 percent gravel, cobbles, and stones; strongly calcareous; moderately alkaline; clear wavy boundary.

IIC2r—15 to 20 inches; calcareous sandstone.

The depth to bedrock is from 11 to 20 inches. The content of gravel, cobbles, and stones in the profile ranges from 45 to 65 percent. Hue ranges from 7.5YR to 10YR. The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to loam and is gravelly, very gravelly, cobbly, very cobbly, stony, or very stony. The A horizon can be mildly alkaline or moderately alkaline. The Bt horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture is loam, sandy clay loam, or clay loam and is modified by coarse fragments. Clay films occur on peds or as bridges between mineral grains. The clay films are thin or moderately thick and patchy or continuous. The Bt horizon is mildly alkaline or moderately alkaline. Generally, this horizon is noncalcareous, but in some places it is calcareous. The C1ca horizon has value of 5 to 8 dry and 4 to 6 moist; it has chroma of 2 or 3. The texture ranges from loam to fine sandy loam or sandy clay loam and is gravelly to very gravelly, cobbly, very cobbly, stony, or very stony. It is moderately alkaline or strongly alkaline.

4E—Brownrigg-Featherlegs-Wolf complex, 10 to 40 percent slopes. This complex consists of about 35 percent Brownrigg very cobbly loam that has 10 to 40 percent slopes, about 25 percent Featherlegs loam that has 10 to 20 percent slopes, and about 25 percent Wolf loam that has 10 to 20 percent slopes (fig. 1). The moderately steep Brownrigg soil is on steep upland breaks, steep shoulder ridges, and mountain foot slopes. The hilly Featherlegs and Wolf soils are on the hilly topography between the upland breaks and steeper mountain foot slopes. Included in mapping and making up about 15 percent of the acreage are small areas of Dix gravelly sandy loam, Lambman loam, Motoqua very gravelly loam, Rosebud fine sandy loam, Satanta loam, Wendover very gravelly fine sandy loam, Willowman gravelly fine sandy loam, and areas of Sandstone outcrop.

Runoff on Featherlegs and Wolf soils is medium to rapid. The hazard of erosion is moderate to severe, and the hazard of soil blowing is moderate. Runoff on the Brownrigg soil is medium. The hazard of erosion is moderate, and the hazard of soil blowing is moderate.

These soils are used as range and for wildlife food and cover. Capability unit VIIe-14, dryland; Brownrigg part, Shallow loamy range site; Unsuitable windbreak site. Featherlegs and Wolf parts, Loamy range site; Silty to clayey windbreak site.

Dailey series

The Dailey series consists of deep, somewhat excessively drained, nearly level to rolling soils in drainageways and on uplands. These soils formed in alluvium and wind-deposited and reworked sand that originated from noncalcareous sandstone. Slopes are 0 to 10 percent. The vegetation is needleandthread, prairie sandreed, and blue grama.

In a representative profile the surface layer is grayish brown loamy fine sand 2 inches thick. The next layer is brown loamy fine sand 15 inches thick. The underlying material is brown and pale brown loamy fine sand.

These soils are rapidly permeable. The available water capacity is 4.8 to 6.6 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover.

A representative profile of Dailey loamy fine sand, in an area of Dailey-Valent loamy fine sands, 0 to 3 percent slopes, 300 feet north and 430 feet east of the southwest corner of sec. 20, T. 29 N., R. 60 W.

A1—0 to 2 inches; grayish brown (10YR 5/2) loamy fine sand, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft,

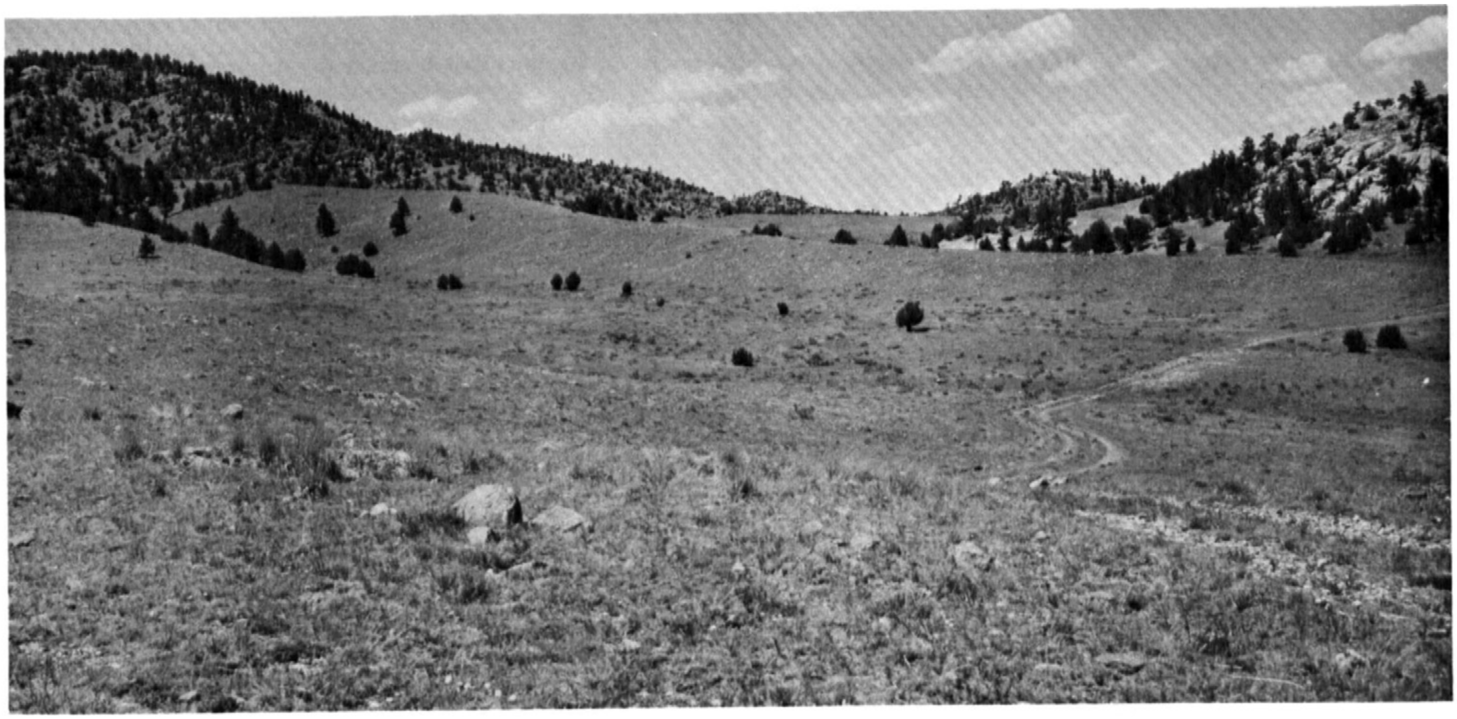

Figure 1.—**Brownrigg very cobbly loam is the soil in the foreground. Featherlegs and Wolf loams are on the lower side slopes in the background, and Motoqua-Rock outcrop complex, 20 to 60 percent slopes, is on the hillsides.**

very friable, nonsticky and nonplastic; neutral; gradual smooth boundary.

AC—2 to 17 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak medium subangular blocky structure; soft, very friable, nonsticky and nonplastic; mildly alkaline; gradual smooth boundary.

C1—17 to 36 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; single grained; loose, nonsticky and nonplastic; mildly alkaline; gradual smooth boundary.

C2—36 to 60 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose, nonsticky and nonplastic; mildly alkaline.

The soil material is loamy fine sand or fine sand throughout the profile. It generally is noncalcareous, but in some profiles carbonates occur below a depth of 36 inches. The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma or 2 or 3. The AC horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The C horizon has value of 5 to 7 dry and 4 to 6 moist and chroma of 2 or 3.

5A—Dailey-Valent loamy fine sands, 0 to 3 percent slopes. This complex consists of about 65 percent Dailey loamy fine sand and 25 percent Valent loamy fine sand. The Dailey soil is in drainageways and on more nearly level uplands, and the Valent soil is on knobs and steeper uplands. Included with these soils in mapping are about 5 percent Dwyer loamy fine sand and 5 percent Valent fine sand.

Runoff is very slow. The hazard of erosion is slight, and the hazard of soil blowing is very severe.

This complex is used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover. Capability unit IVe–4, dryland; IIIs–4, irrigated; Sandy range site; Sandy windbreak site.

5C—Dailey-Valent loamy fine sands, 3 to 10 percent slopes. This complex consists of about 45 percent Dailey loamy fine sand and 45 percent Valent loamy fine sand. The undulating to rolling Dailey soil is in drainageways and on back slopes and toe slopes of uplands. The Valent soil is on knobs and the steeper side slopes of uplands. Included in mapping and making up about 10 percent of the acreage are Dwyer loamy fine sand and Valent fine sand.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is very severe.

This complex is used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover. Capability unit VIe–4, dryland; IVe–4, irrigated; Sandy range site; Very sandy windbreak site.

Dix series

The Dix series consists of deep, excessively drained, nearly level soils on breaks and dissected alluvial fans and terraces. These soils formed in very gravelly alluvium that was derived from mixed rock. Slopes are 0 to 40 percent. The vegetation is blue grama, threadleaf sedge, needleandthread, western wheatgrass, and yucca.

In a representative profile the surface layer is brown gravelly sandy loam about 4 inches thick (fig. 2). The next layer is brown calcareous very gravelly sandy loam 5 inches thick. The underlying material to a depth of 14 inches is pale brown calcareous very gravelly sandy loam. Below this, it is sand and gravel.

This soil has rapid permeability in the upper part of the profile and very rapid permeability in the underlying sand and gravel. The available water capacity is 2.4 to 2.6 inches. The effective rooting depth is 60 inches or more, but for root sensitive crops it is 14

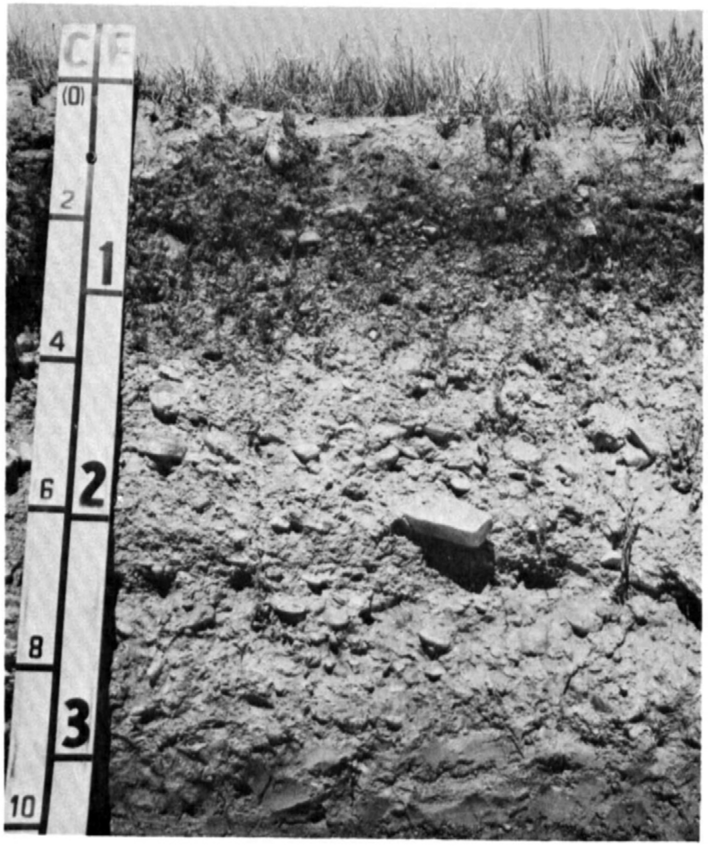

Figure 2.—**Profile of Dix gravelly sandy loam.**

inches because of the sand and gravel in the substratum.

These soils are used as range and for wildlife food and cover.

A representative profile of Dix gravelly sandy loam, in an area of Dix-Alice complex, 0 to 10 percent slopes, 2,380 feet east and 2,130 feet north of the southwest corner of sec. 8, T. 25 N., R. 62 W.

A1—0 to 4 inches; brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; 35 percent gravel and cobbles; mildly alkaline; clear wavy boundary.

AC—4 to 9 inches; brown (10YR 4/3) very gravelly sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; soft, very friable, slightly sticky and slightly plastic; 55 percent gravel and cobbles; slightly calcareous; moderately alkaline; clear wavy boundary.

C1ca—9 to 14 inches; pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 5/3) moist; massive; soft, very friable, slightly sticky and slightly plastic; 70 percent pebbles and cobbles; strongly calcareous; moderately alkaline; gradual wavy boundary.

IIC2—14 to 60 inches; sand and gravel.

Depth to sand and gravel ranges from 12 to 18 inches. Pebbles and cobbles are scattered on the surface except in some places. The content of pebbles and cobbles generally increases with depth. Reaction ranges from mildly alkaline to moderately alkaline throughout the profile. The A1 and AC horizons have value of 2 or 3 moist and chroma of 2 or 3. These horizons can be loam, sandy loam, or loamy sand with varying amounts of pebbles and cobbles. Typically, these horizons have weak fine granular structure, but the AC horizon has weak prismatic or subangular blocky structure in places. The C1ca horizon has value of 6 or 7 dry and 5 or 6 moist; it has chroma of 2 or 3. This horizon is generally calcareous but is noncalcareous in some profiles. The IIC2 horizon in the upper few inches has pebbles that are coated with lime. The IIC2 horizon is generally calcareous to a depth of more than 40 inches. This horizon is commonly composed of sand and gravel with mixed mineralogy, but in a few places it has fragments of Brule or other underlying rock.

6C—Dix-Alice complex, 0 to 10 percent slopes. This complex consists of about 55 percent Dix gravelly sandy loam that has 0 to 10 percent slopes and about 30 percent Alice fine sandy loam, 0 to 6 percent slopes, Dailey-Valent loamy fine sands, 0 to 3 percent slopes, and Vetal fine sandy loam, 0 to 6 percent slopes. The Dix soil has the profile described as representative of the series.

The Dix soil is nearly level to sloping and is on narrow ridges and knobs of terrace breaks and dissected alluvial terraces. Alice, Dailey, Valent, and Vetal soils are gently sloping and are in drainageways and on foot slopes and toe slopes of terrace breaks and dissected alluvial terraces. Included in mapping and making up about 15 percent of the acreage are areas of Epping loam, Manter sandy loam, Otero fine sandy loam, and Trelona fine sandy loam.

Runoff is medium. The hazard of erosion is moderate, and the hazard of soil blowing is severe.

This complex is used as range and for wildlife food and cover. Capability unit VIs-6, dryland; Dix part, Gravelly range site and Unsuitable windbreak site; Alice part, Sandy range site and Sandy windbreak site.

6E—Dix-Alice complex, 10 to 40 percent slopes. This complex consists of about 65 percent Dix gravelly sandy loam that has 10 to 40 percent slopes and about 25 percent Alice fine sandy loam, 0 to 6 percent slopes, Dailey-Valent loamy fine sand, 3 to 10 percent slopes, and Vetal fine sandy loam, 0 to 6 percent slopes. The Dix soil is moderately steep to steep on narrow ridges and knobs of terrace breaks and dissected alluvial terraces (fig. 3). The nearly level to sloping Alice, Dailey, Valent, and Vetal soils are in drainageways and on foot slopes and toe slopes of terrace breaks and dissected alluvial terraces. Included in mapping and making up about 10 percent of the acreage are areas of Epping loam, Manter sandy loam, Otero fine sandy loam, and Trelona fine sandy loam.

Runoff is rapid. The hazard of erosion is severe, and the hazard of soil blowing is severe.

This complex is used as range and for wildlife food and cover. Capability unit VIIs-6, dryland; Dix part, Gravelly range site and Unsuitable windbreak site; Alice part, Sandy range site and Sandy windbreak site.

Dune land

7—Dune land conists of hills and ridges of sand drifted by the wind. These dunes are either actively shifting or so recently stabilized that no soil horizons have developed. The shifting sands have formed pockets and closed basins that have no surface drainage. The vegetation is too sparse to prevent soil blowing. These dunes migrate from northwest to southeast in the di-

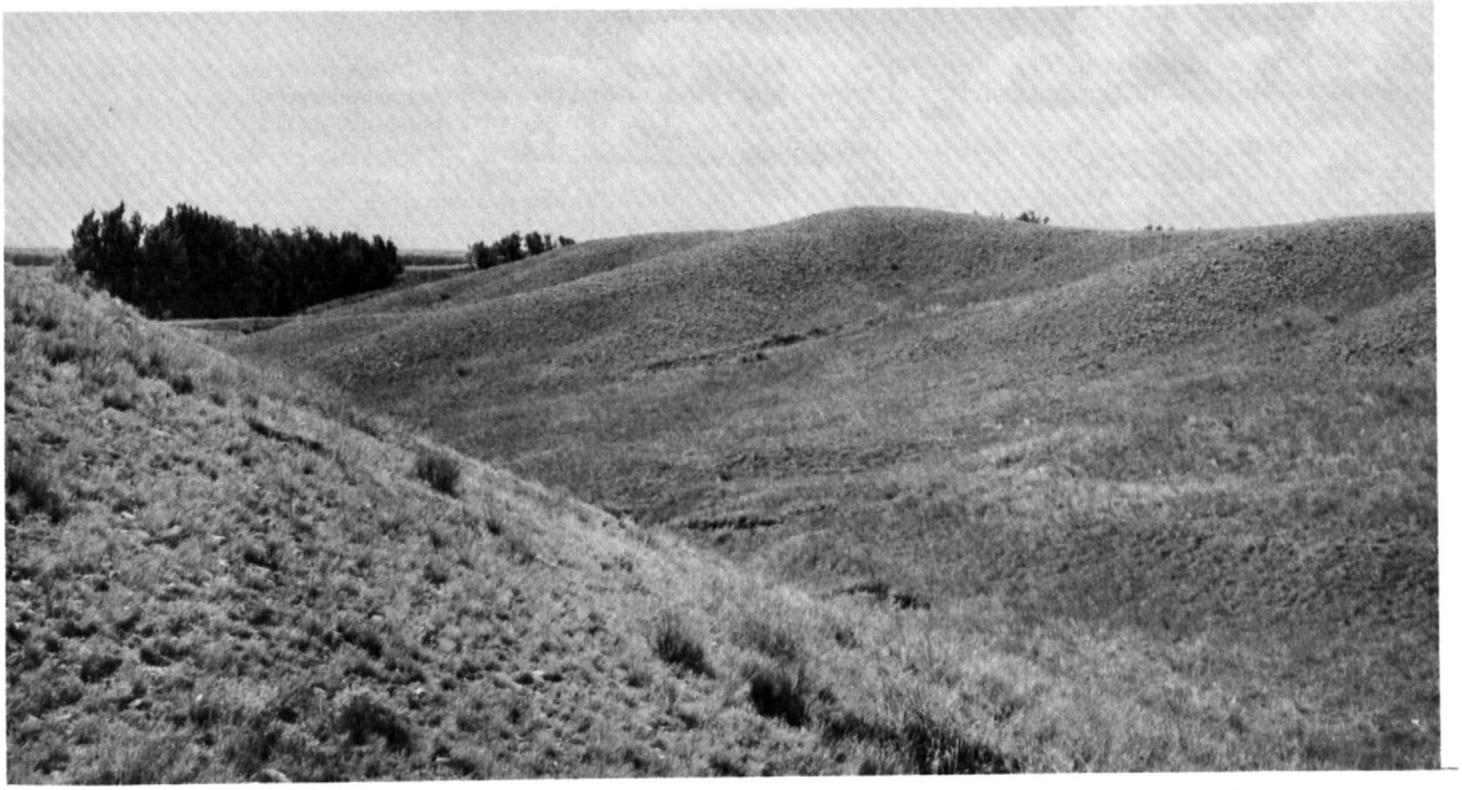

Figure 3.—In this area of Dix-Alice complex, 10 to 40 percent slopes, Dix gravelly sandy loam is on the convex side slopes and ridge crests. Alice fine sandy loam is on concave side slopes and along the drainageway.

rection of the prevailing winds. Dune land is not suited to commercial plant production.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is very severe. Capability unit VIIIe-15, dryland; not assigned to a range site or windbreak site.

Dwyer series

The Dwyer series consists of deep, excessively drained, undulating to hilly soils on sandy dissected terraces. These soils formed in wind-deposited and reworked sand that originated from calcareous sandstone. Slopes are 3 to 20 percent. The vegetation is prairie sandreed, needleandthread, and blue grama.

In a representative profile the surface layer is light brownish gray loamy fine sand 5 inches thick. The next layer is pale brown loamy fine sand 19 inches thick. The underlying material is very pale brown loamy fine sand.

These soils have very rapid permeability. The available water capacity is 4.8 to 6.6 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover.

A representative profile of Dwyer loamy fine sand, in an area of Valent-Dwyer loamy fine sands, 0 to 3 percent slopes, 1,385 feet south and 1,385 feet east of the northwest corner of sec. 2, T. 26 N., R. 64 W.

A1—0 to 5 inches; light brownish gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; loose, nonsticky and nonplastic; mildly alkaline; gradual smooth boundary.

AC—5 to 24 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak medium and coarse prismatic structure; soft, very friable, nonsticky and nonplastic, slightly calcareous; moderately alkaline; gradual wavy boundary.

C—24 to 60 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose, nonsticky and nonplastic; calcareous; moderately alkaline.

The profile is commonly calcareous, but it may be leached in the upper few inches. This soil may have accumulations of secondary calcium carbonate but does not have a continuous Cca horizon. The A1 horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. It is mildly alkaline or moderately alkaline. The A1 horizon commonly has weak structure but in places is single grained. The AC horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. This horizon commonly has weak structure, but in places it is single grained. The C horizon has value of 6 or 7 dry and 5 or 6 moist and chroma of 2 or 3. In some places it has seams of calcium carbonate. The texture is loamy fine sand or fine sand.

8D—Dwyer-Valent-Tassel complex, 3 to 20 percent slopes. This complex consists of about 35 percent Dwyer loamy fine sand, 30 percent Valent loamy fine sand, and about 25 percent Tassel fine sandy loam. The Dwyer soil is on the back slopes and foot slopes of the hilly dissected upland. The Tassel soil is in upland summit areas and on shoulder slopes. The Valent soil is on toe slopes and side slopes and in closed basins. The mapped areas are about 10 percent Dailey loamy fine sand, Embry fine sandy loam, Jayem fine sandy loam, Satanta fine sandy loam, and Trelona fine sandy loam.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is very severe.

This complex is used as range and for wildlife food and cover. Capability unit VIe-15, dryland; Dwyer and Valent parts, Sandy range site and Sandy windbreak site; Tassel part, Shallow sandy range site and Unsuitable windbreak site.

Embry series

The Embry series consists of deep, well drained, nearly level to sloping soils on alluvial fans and valley-filling foot slopes of dissected terraces. These soils formed in noncalcareous alluvium from sandstone. Slopes are 0 to 10 percent. The vegetation is blue grama, needleandthread, and scattered prairie sandreed.

In a representative profile the surface layer is grayish brown fine sandy loam 9 inches thick. The next layer is brown fine sandy loam 14 inches thick. The underlying material is light brownish gray and pale brown fine sandy loam.

These soils are rapidly permeable. The available water capacity is 7.8 to 9.0 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for windbreaks and wildlife food and cover.

A representative profile of Embry fine sandy loam, 0 to 3 percent slopes, 2,080 feet east and 595 feet north of the southwest corner of sec. 29, T. 29 N., R. 62 W.

A1—0 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; gradual smooth boundary.

AC—9 to 23 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium and coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; gradual smooth boundary.

C1—23 to 35 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; gradual wavy boundary.

C2—35 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The content of coarse fragments in the profile ranges from 0 to 15 percent but typically is less than 5 percent. The fragments are mainly sandstone. The A1 horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. The texture is fine sandy loam or loamy very fine sand. The AC horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 3 or 4. It is neutral or mildly alkaline. The C horizon has value of 6 or 7 dry and 5 or 6 moist and chroma of 2 or 3.

9A—Embry fine sandy loam, 0 to 3 percent slopes. This nearly level soil is in drainageways and on foot slopes and toe slopes of dissected terraces. This soil has the profile described as representative of the series. Included in mapping and making up about 10 percent of the acreage are small areas of Dailey loamy fine sand, Jayem fine sandy loam, and Valent loamy fine sand.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is severe.

This soil is used as range and for windbreaks and wildlife food and cover. Capability unit IVe-5, dryland; Sandy range site; Sandy windbreak site.

9C—Embry fine sandy loam, 3 to 10 percent slopes. This gently sloping to sloping soil is on foot slopes and toe slopes of dissected terraces. It has a profile similar to the one described as representative of the series. About 10 percent of the mapped acreage is small areas of Dailey loamy fine sand, Jayem fine sandy loam, and Valent loamy fine sand.

Runoff is medium. The hazard of erosion is moderate, and the hazard of soil blowing is severe.

This soil is used as range and for windbreaks and wildlife food and cover. Capability unit VIe-5, dryland; Sandy range site; Sandy windbreak site.

Epping series

The Epping series consists of shallow, well drained, nearly level to rolling soils on dissected table lands. These soils formed in material weathered from soft, calcareous Brule siltstone. Slopes are 0 to 10 percent. The vegetation is blue grama, needleandthread, western wheatgrass, smooth brome, snakeweed, and cactus.

In a representative profile the surface layer is pale brown calcareous loam 3 inches thick. The underlying material, to a depth of 13 inches, is very pale brown calcareous loam. Below this, it is fractured, soft, calcareous siltstone.

These soils are moderately permeable. The available water capacity is 2.0 to 2.3 inches. The effective rooting depth is 10 to 20 inches.

These soils are used as range and for wildlife food and cover.

A representative profile of Epping loam, 0 to 10 percent slopes, 395 feet west and 1,385 feet north of the southeast corner of sec. 16, T. 26 N., R. 60 W.

A1—0 to 3 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak to moderate fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; clear smooth boundary.

C1—3 to 13 inches; very pale brown (10YR 8/4) loam, light yellowish brown (10YR 6/4) moist; weak fine and medium subangular blocky structure parting to weak fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; strongly calcareous; clear smooth boundary.

C2r—13 to 18 inches; fractured, soft, calcareous siltstone.

Fragments of siltstone are on the surface and mixed throughout the profile in some places, but generally they make up less than 15 percent of the volume of soil material. The A1 horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. The texture ranges from sandy loam to silt loam. The A1 horizon is soft to slightly hard, and reaction is mildly to moderately alkaline. The C horizon has value of 6 through 8 dry and 5 or 6 moist and chroma of 2 to 4. It generally is loam but is sandy loam or silt loam in some places. The reaction ranges from moderately alkaline to strongly alkaline. The C2r horizon is fractured or massive, soft calcareous siltstone at a depth of 10 to 20 inches.

10C—Epping loam, 0 to 10 percent slopes. This nearly level to rolling soil is on ridges of dissected tablelands. Included in mapping and making up about 5 percent of the total acreage are small areas of Keota loam, Mitchell loam, and Tassel fine sandy loam.

Runoff is medium. The hazards of erosion and soil blowing are severe. This soil is used as range and for wildlife food and cover. Capability unit VIIe-14, dryland; Shallow loamy range site; Unsuitable windbreak site.

Featherlegs series

The Featherlegs series consists of deep, well drained, nearly level to hilly soils on terraces. These soils formed in calcareous colluvium and alluvium. Slopes are 0 to 20 percent. The vegetation is western wheatgrass, blue grama, threadleaf sedge, Sandberg bluegrass, and needleandthread.

In a representative profile the surface layer is dark grayish brown loam 5 inches thick. The subsoil is brown and light brownish gray clay loam 18 inches thick. The substratum, to a depth of 38 inches, is light brownish gray loam. Below this, it is light brownish gray very gravelly sandy loam.

These soils have moderately slow permeability. The available water capacity is 6.6 to 7.4 inches. The effective rooting depth is 60 inches or more. These soils are used as range and for dryland crops, windbreaks, and wildlife food and cover.

A representative profile of Featherlegs loam, in an area of Featherlegs-Wolf loams, 0 to 6 percent slopes, 2,706 feet south and 726 feet east of the northwest corner of sec. 16, T. 30 N., R. 64 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse granular structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B1—5 to 10 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine and coarse subangular blocky structure; hard, friable, sticky and plastic; mildly alkaline; clear wavy boundary.

B2t—10 to 19 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; strong fine and coarse subangular blocky structure; very hard, firm, sticky and plastic; common moderately thick clay films on peds; mildly alkaline; clear wavy boundary.

B3ca—19 to 23 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate fine and coarse subangular blocky structure; hard, friable, sticky and plastic; strongly calcareous; moderately alkaline; gradual wavy boundary.

C1ca—23 to 38 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; moderate fine and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; strongly calcareous, secondary lime mainly disseminated; moderately alkaline; clear wavy boundary.

IIC2—38 to 60 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; 65 percent gravel and cobbles; strongly calcareous; moderately alkaline.

The depth to calcareous material ranges from 8 to 20 inches. The content of coarse fragments in the A and B horizons ranges from 0 to 15 percent, but it is typically less than 5 percent. In the IIC2 horizon, the content of gravel and cobbles ranges from 55 to 75 percent, and there are a few stones. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to loam. The A1 horizon is neutral to mildly alkaline. The B horizon has hue of 7.5YR or 10YR. The texture is clay loam or sandy clay loam. The C horizon has value of 6 or 7 dry and 5 or 6 moist.

11B—Featherlegs-Wolf loams, 0 to 6 percent slopes. This complex is on outwash terraces. It consists of about 50 percent Featherlegs loam that has 0 to 3 percent slopes and about 40 percent Wolf loam that has 3 to 6 percent slopes (fig. 4). These soils have the profile described as representative of their series. The Featherlegs soil is nearly level, and the Wolf soil is undulating. About 10 percent of the mapped areas of this complex consists of Brownrigg very cobbly loam, Lambman loam, and Willowman gravelly fine sandy loam.

Runoff is slow to medium. The hazard of erosion is slight, and the hazard of soil blowing is slight.

This complex is used as range and for dryland crops, windbreaks, and wildlife food and cover. Capability unit IIIe-2, dryland; Loamy range site; Silty to clayey windbreak site.

11C—Featherlegs-Wolf loams, 6 to 10 percent slopes. This complex consists of about 55 percent Wolf loam and about 30 percent Featherlegs loam. The Featherlegs soil is in swales and depressions and on the smoother slopes, and the Wolf soil is on low, narrow, or broad ridges on terraces in the uplands. The mapped areas are about 15 percent Brownrigg very cobbly loam, Lambman loam, and Willowman gravelly fine sandy loam.

Runoff is medium. The hazard of erosion is moderate, and the hazard of soil blowing is slight.

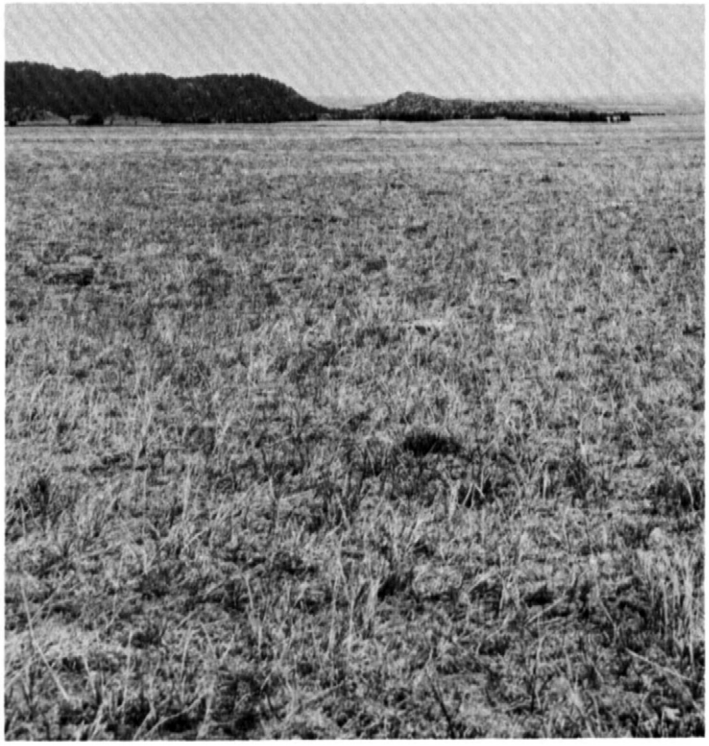

Figure 4.—An area of Featherlegs-Wolf loams, 0 to 6 percent slopes.

This complex is used as range and for windbreaks and wildlife food and cover. Capability unit IVe–2, dryland; Loamy range site; Silty to clayey windbreak site.

12C—Featherlegs-Wolf-Brownrigg complex, 3 to 10 percent slopes. This complex consists of about 35 percent Featherlegs loam that has 3 to 6 percent slopes; about 30 percent Wolf loam that has 3 to 6 percent slopes; and about 25 percent Brownrigg very cobbly loam that has 6 to 10 percent slopes. The undulating Featherlegs and Wolf soils are between low shoulder ridges and slightly higher dissected terraces and mountain foot slopes. The rolling Brownrigg soil is on shoulder ridges and slightly higher dissected terraces and mountain foot slopes. About 10 percent of the mapped acreage is small areas of Dix gravelly sandy loam, Lambman loam, Rosebud fine sandy loam, Satanta loam, Willowman gravelly fine sandy loam, and Sandstone outcrop.

Runoff is slow to medium. The hazards of water erosion and soil blowing are slight on the Featherlegs and Wolf soils and moderate on the Brownrigg soil.

This complex is used as range and for windbreaks and wildlife food and cover. Capability unit VIe–14, dryland; Featherlegs and Wolf parts, Loamy range site and Silty to clayey windbreak site; Brownrigg part, Shallow loamy range site and Unsuitable windbreak site.

Fluvaquents

Fluvaquents are somewhat poorly drained soils on flood plains. They are made up of stratified water-deposited material that has variable texture and little or no horizon development. The water table fluctuates with the stream level. These soils support a variety of water-tolerant plants.

Fluvaquents are mapped only with Torrifluvents.

Hargreave series

The Hargreave series consists of moderately deep, nearly level to rolling, well drained soils on dissected tablelands. These soils formed in eolian sand or in materials weathered from soft, noncalcareous sandstone. Slopes are 0 to 10 percent. The vegetation is needleandthread, blue grama, green needlegrass, threadleaf sedge, Sandberg bluegrass, and western wheatgrass.

In a representative profile the surface layer is dark grayish brown sandy loam 4 inches thick. The subsoil is dark brown and brown sandy clay loam 15 inches thick. The substratum is pale brown fine sandy loam to a depth of 32 inches. Below this is soft, noncalcareous sandstone.

These soils are moderately permeable. The available water capacity is 4.2 to 4.9 inches. The effective rooting depth is 20 to 40 inches.

These soils are used as rangeland and dry cropland and for irrigated hay and pasture, windbreaks, and wildlife food and cover.

A representative profile of Hargreave sandy loam, in an area of Rosebud-Hargreave fine sandy loams, 0 to 6 percent slopes, 2,475 feet north and 1,780 feet east of the southwest corner of sec. 6, T. 30 N., R. 62 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; weak very fine and fine granular structure; soft, loose, slightly sticky and nonplastic; clear smooth boundary.

B2t—4 to 14 inches; dark brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; strong fine and medium prismatic structure parting to strong fine medium subangular blocky; very hard, firm, sticky and plastic; many moderately thick clay films on vertical and horizontal faces of peds; neutral; clear smooth boundary.

B3t—14 to 19 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, sticky and plastic; common thin clay films; common very fine pores; mildly alkaline; gradual wavy boundary.

C1—19 to 32 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; mildly alkaline; gradual wavy boundary.

C2r—32 to 36 inches; soft, fine grained, noncalcareous sandstone.

The A horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. Texture ranges from loamy very fine sand to fine sandy loam. Reaction is neutral or mildly alkaline. The B2t horizon has value of 4 or 5 dry and 3 or 4 moist and chroma of 2 or 3. The texture is sandy loam or sandy clay loam. Clay films occur on faces of peds or as bridges between mineral grains. The films range from thin and patchy to moderately thick and continuous. The reaction is neutral or mildly alkaline. The B3t horizon is sandy loam or sandy clay loam. The C1 horizon has value of 6 or 7 dry and 4 or 5 moist.

13B—Hargreave-Noden sandy loams, 0 to 6 percent slopes. This complex consists of nearly level to undulating soils on dissected tablelands. Areas are about 50 percent Hargreave sandy loam and about 35 percent Noden sandy loam. The Hargreave soil is on low, narrow or broad ridges, and the Noden soil is on smooth slopes. Included in mapping and making up about 15 percent of the acreage are areas of Jayem fine sandy loam, Trelona fine sandy loam, Vetal fine sandy loam, Rosebud fine sandy loam, and Satanta fine sandy loam.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is severe. These soils are used as range and irrigated hayland and pasture and for dryland crops, windbreaks and wildlife food and cover. Capability unit IIIe–5, dryland; IIe–5, irrigated; Loamy range site; Sandy windbreak site.

13C—Hargreave-Noden sandy loams, 6 to 10 percent slopes. This complex of rolling soils is on dissected tablelands. It is about 45 percent Hargreave sandy loam, and about 40 percent Noden sandy loam. Included in mapping and making up about 15 percent of the acreage are areas of Hargreave-Noden sandy loams, 0 to 6 percent slopes; Trelona fine sandy loam; Jayem fine sandy loam; Vetal fine sandy loam; Rosebud fine sandy loam; and Satanta fine sandy loam.

Runoff is medium to rapid. The hazards of erosion and soil blowing are severe.

These soils are used as range, hayland, and pasture and for dryland crops, irrigated small grain, windbreaks, and wildlife food and cover. Capability unit IVe–5, dryland; IIIe–5, irrigated; Loamy range site; Sandy windbreak site.

Jayem series

The Jayem series consists of deep, well drained, nearly level to rolling soils on dissected tablelands. These soils formed in a surficial layer of eolian sand and in material weathered from noncalcareous sandstone. Slopes are 0 to 10 percent. The vegetation is blue grama, needleandthread, and threadleaf sedge.

In a representative profile the surface layer is grayish brown fine sandy loam 10 inches thick. The subsoil is brown fine sandy loam 12 inches thick. The substratum is light brownish gray fine sandy loam.

These soils are rapidly permeable. The available water capacity is 7.8 to 9.0 inches. The effective rooting depth is 40 to 60 inches or more.

These soils are used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover.

A representative profile of Jayem fine sandy loam, 0 to 3 percent slopes, 1,120 feet south and 15 feet east of the northwest corner of sec. 15, T. 30 N., R. 60 W.

A1—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; soft, very friable, nonsticky and nonplastic; neutral; clear smooth boundary.

B2—10 to 22 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, nonsticky and nonplastic; few thin patchy clay films on vertical faces of peds and in root channels; neutral; gradual wavy boundary.

C—22 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; mildly alkaline.

Some areas have buried horizons in the lower part of the profile. Sandstone is below a depth of 40 inches in some places. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The B2 and C horizons have value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3.

14A—Jayem fine sandy loam, 0 to 3 percent slopes. This nearly level soil is on the summit areas of dissected tablelands. This soil has the profile described as representative of the series. Included in mapping and making up about 10 percent of the total acreage are small areas of Hargreave sandy loam, Manter sandy loam, Satanta fine sandy loam, Trelona fine sandy loam, and Vetal fine sandy loam.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is severe.

This soil is used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover. Capability unit IIIe-5, dryland; IIe-5, irrigated; Sandy range site; Sandy windbreak site.

14C—Jayem fine sandy loam, 3 to 10 percent slopes. This gently sloping to sloping soil is on back slopes, foot slopes, and toe slopes in dissected tablelands. Small areas of Hargreave sandy loam, Manter sandy loam, Satanta fine sandy loam, Trelona fine sandy loam, and Vetal fine sandy loam are included in mapping and make up about 10 percent of the total acreage.

Runoff is medium. The hazard of erosion is moderate, and the hazard of soil blowing is severe.

This soil is used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover. Capability unit IVe-5, dryland; IIIe-5, irrigated; Sandy range site; Sandy windbreak site.

15C—Jayem-Ascalon-Manter complex, 3 to 10 percent slopes. This complex consists of about 30 percent Jayem fine sandy loam, 30 percent Ascalon fine sandy loam, and about 25 percent Manter sandy loam (fig. 5). The Ascalon soil has the profile described as representative of the series. The Jayem soil is on the summit areas of dissected tablelands. The Ascalon soil is on the shoulder and back slopes of the dissected tablelands. The Manter soil is on foot slopes and toe slopes. Included in mapping and making up about 15 percent of the total acreage are areas of Alice fine sandy loam, Vetal fine sandy loam, Trelona fine sandy loam, and Lambman loam.

Runoff is medium. The hazard of erosion is moderate, and the hazard of soil blowing is severe.

This complex is used as range and for dryland crops, windbreaks, and wildlife food and cover. Capability unit IVe-5, dryland; Sandy range site; Sandy windbreak site.

16D—Jayem-Trelona-Manter complex, 3 to 20 percent slopes. This complex of undulating to hilly soils consists of about 35 percent Jayem fine sandy loam, 25 percent Trelona fine sandy loam, and 25 percent Manter sandy loam. The Trelona soil is in narrow upland summit areas and on shoulder slopes. The Manter soil is on the foot slopes, toe slopes, and broad summit areas. The Jayem soil is on back slopes and in narrow drainageways and depressions. Included in mapping are areas of Alice fine sandy loam, Lambman loam, and Noden sandy loam that make up about 15 percent of the total acreage.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is severe.

This complex is used as range and for wildlife food and cover. Capability unit VIe-5, dryland; Jayem and Manter parts, Sandy range site and Sandy windbreak site; Trelona part, Shallow sandy range site and Unsuitable windbreak site.

Keota series

The Keota series consists of moderately deep, well drained soils that formed in material weathered from soft Brule siltstone. These soils are nearly level to rolling and occur on dissected tablelands. Slopes are 0 to 10 percent. The vegetation is blue grama, needleandthread, and threadleaf sedge.

In a representative profile the surface layer is brown loam 3 inches thick (fig. 6). The next layer is pale brown loam 7 inches thick. The underlying material, at a depth of 36 inches, is pale brown and very pale brown loam. Below this, it is soft, calcareous siltstone.

These soils are moderately permeable. The available water capacity is 5.7 to 6.4 inches. The effective rooting depth is 20 to 40 inches.

These soils are used as range and for dryland crops, windbreaks, and wildlife food and cover.

A representative profile of Keota loam, 0 to 6 percent slopes, 2,575 feet south and 265 feet west of the northeast corner of sec. 6, T. 26 N., R. 60 W.

A1—0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; weak medium subangular blocky structure parting to weak medium and coarse granular; soft, very friable, slightly sticky and slightly plastic; moderately alkaline; clear smooth boundary.

AC—3 to 10 inches; pale brown (10YR 6/3) loam, dark

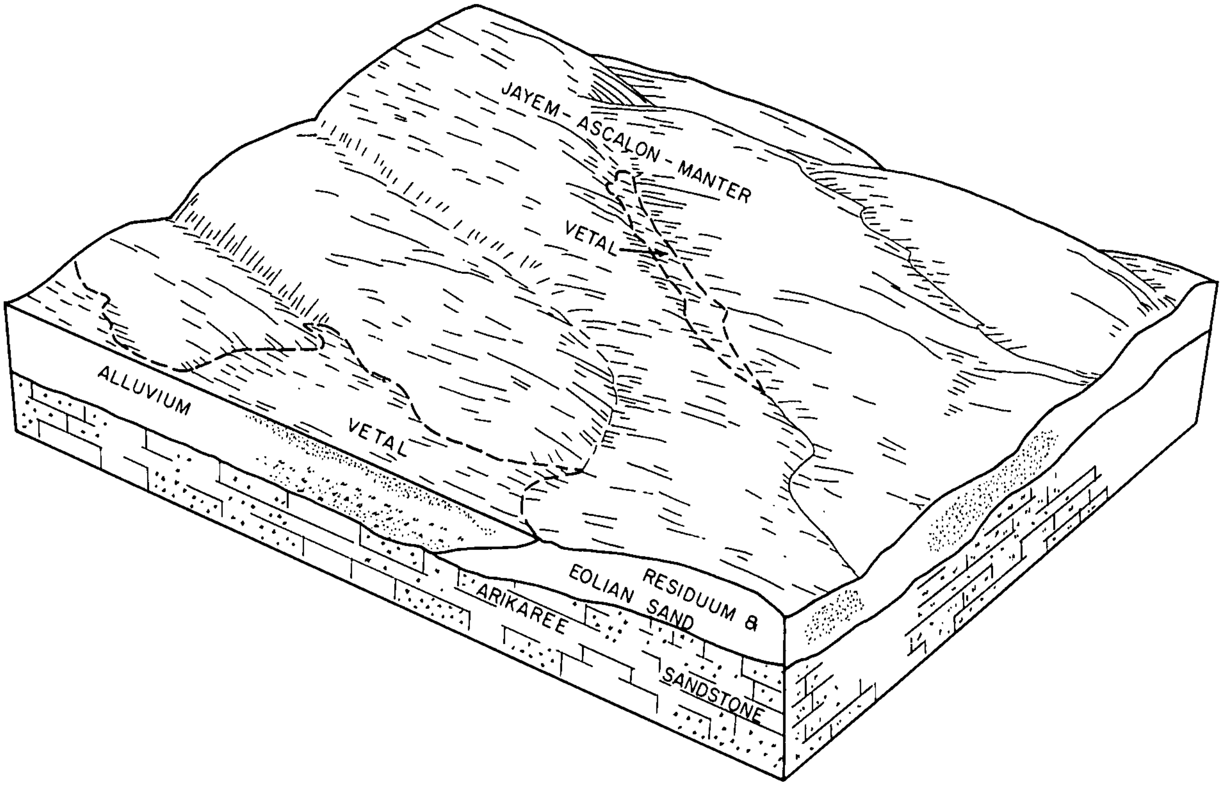

Figure 5.—Typical landscape and parent material of Jayem-Ascalon-Manter soils and Vetal soils.

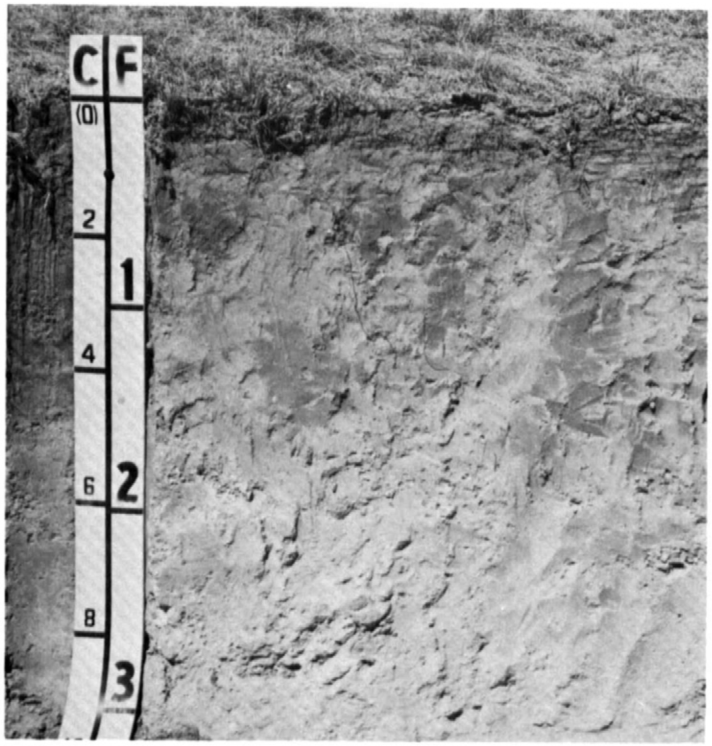

Figure 6.—Profile of Keota loam.

brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline; gradual smooth boundary.

C1—10 to 20 inches; pale brown (10YR 6/3) loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline; gradual wavy boundary.

C2—20 to 36 inches; very pale brown (10YR 7/3) loam, grayish brown (10YR 5/2) moist; massive; soft to slightly hard, slightly sticky and slightly plastic; calcareous; moderately alkaline; clear wavy boundary.

C3r—36 to 40 inches; soft, calcareous siltstone.

These soils generally are calcareous throughout, but depth to uniformly calcareous material ranges from 0 to 5 inches. Depth to siltstone bedrock ranges mainly from 26 to 36 inches. Continuous subhorizons of secondary calcium carbonate do not occur, although some accumulation is visible in some places. The A horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 or 3. Texture ranges from sandy loam to silt loam. The A horizon generally is calcareous but in places is leached of carbonates. The AC horizon generally is loam but is sandy loam or silt loam in places. It has value of 6 or 7 dry and 4 or 5 moist and chroma of 2 or 3. The reaction is generally moderately alkaline but in places is strongly alkaline. The C1 and C2 horizons are loam or silt loam and moderately alkaline or strongly alkaline. Siltstone fragments make up 5 to 10 percent of these horizons.

17B—Keota loam, 0 to 6 percent slopes. This nearly level to undulating soil is on dissected tablelands. It has the profile described as representative of the series. Included in mapping and making up about 10 percent of the total acreage are small areas of Epping loam and Mitchell loam.

Runoff is slow to medium. The hazard of erosion is moderate, and the hazard of soil blowing is severe. This soil is used as range and for dryland crops, windbreaks, and wildlife food and cover. Capability unit IVe-3, dryland; Loamy range site; Silty to clayey windbreak site.

18C—Keota-Epping loams, 6 to 10 percent slopes. This complex consists of rolling soils on dissected tableland. It consists of about 60 percent Keota loam and about 35 percent Epping loam. The Keota soil is on the smooth parts of the landscape, and the Epping soil is on the low ridges. Included in mapping is about 5 percent Mitchell loam.

Runoff is rapid. The hazards of erosion and soil blowing are severe.

These soils are used as range and for wildlife food and cover. The Keota soil is used for windbreaks. Capability unit VIe-14, dryland; Keota part, Loamy range site and Silty to clayey windbreak site; Epping part, Shallow loamy range site and Unsuitable windbreak site.

Lambman series

The Lambman series consists of shallow, well drained soils that formed in a mantle of eolian sand and material weathered from noncalcareous sandstone. The soils are undulating to hilly on dissected terraces and toe slopes of mountains. Slopes are 3 to 20 percent. The vegetation is blue grama, threadleaf sedge, western wheatgrass, prairie junegrass, green needlegrass, needleandthread, and fringe sage.

In a representative profile the surface layer is dark grayish brown loam 3 inches thick. The subsoil is brown clay loam and loam 15 inches thick. It is underlain at a depth of 18 inches by noncalcareous sandstone.

These soils have moderately slow permeability. The available water capacity is 2.9 to 3.2 inches. The effective rooting depth is 10 to 20 inches.

These soils are used as range and for wildlife food and cover.

A representative profile of Lambman loam, in an area of Satanta-Willowman-Lambman complex, 3 to 20 percent slopes, 265 feet east and 1,520 feet north of the southwest corner of sec. 2, T. 30 N., R. 65 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine granular structure; slightly hard, very friable, slightly sticky and slightly plastic; neutral; clear smooth boundary.

B21t—3 to 10 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; strong medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films; mildly alkaline; clear smooth boundary.

B22t—10 to 14 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; strong fine and medium subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films; mildly alkaline; gradual wavy boundary.

B3—14 to 18 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; clear wavy boundary.

Cr—18 to 22 inches; noncalcareous sandstone.

Depth to bedrock ranges from 10 to 20 inches. The content of gravel ranges from 0 to 35 percent. Pebbles and stones are scattered on the surface and through the profile. Hue ranges from 2.5 to 7.5YR. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to loam. Reaction is neutral or mildly alkaline. The B horizon is loam, sandy clay loam, or clay loam. This horizon has value of 2 to 4 moist and chroma of 2 or 3. Clay films occur on peds or as bridges between the mineral grains, and the films range from thin to thick and are continuous.

Lambman soils are mapped only with Satanta and Willowman soils.

Manter series

The Manter series consists of deep, well drained, undulating to hilly soils on dissected tableland. These soils formed in eolian sand and materials weathered in place from calcareous and noncalcareous soft sandstone. Slopes are 3 to 20 percent. The vegetation is needleandthread, blue grama, Sandberg bluegrass, and fringed sagewort.

In a representative profile, the surface layer is brown sandy loam 5 inches thick. The subsoil is dark grayish brown and grayish brown sandy loam and fine sandy loam 21 inches thick. The substratum is brown and light brownish gray fine sandy loam.

These soils are rapidly permeable. The available water capacity is 7.5 to 8.7 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for dryland and irrigated crops, windbreaks, and wildlife food and cover.

A representative profile of Manter sandy loam, in an area of Jayem-Ascalon-Manter complex, 3 to 10 percent slopes, 265 feet east and 100 feet north of the southwest corner of sec. 16, T. 29 N., R. 61 W.

A1—0 to 5 inches; brown (10YR 4/3) sandy loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, very friable; slightly sticky and slightly plastic; neutral; clear smooth boundary.

B2t—5 to 17 inches; dark grayish brown (10YR 4/2) sandy loam; very dark grayish brown (10YR 3/2) moist; moderate medium and coarse prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films as bridges between mineral grains; mildly alkaline; gradual smooth boundary.

B3t—17 to 26 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium prismatic structure parting to moderate fine and medium subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films as bridges between mineral grains; mildly alkaline; gradual smooth boundary.

C1—26 to 36 inches; brown (10YR 5/3) fine sandy loam; dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; mildly alkaline; gradual wavy boundary.

C2ca—36 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam; grayish brown (10YR 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; calcareous; moderately alkaline.

The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. Texture ranges from sandy loam to very fine sandy loam. Reaction is neutral to mildly alkaline. The B horizon has value of 2 to 4 moist and chroma of 2 or 3. It is mildly alkaline to moderately alkaline. The C horizon has value of 6 to 7 dry and 5 to 6 moist. It ranges from mildly alkaline to strongly alkaline.

Manter soils are mapped only with Ascalon, Jayem, and Trelona soils.

Mitchell series

Mitchell soils are deep and well drained. They formed in material that was derived from soft, calcareous siltstone on terraces, alluvial fans, and colluvial deposits. These soils are nearly level to hilly on dissected tablelands. Slopes range from 0 to 20 percent. The vegetation is blue grama, needleandthread, western wheatgrass, and threadleaf sedge.

In a representative profile the surface layer is brown loam 3 inches thick. The next layer is grayish brown loam 6 inches thick. The underlying material is brown and light brownish gray loam.

These soils are moderately permeable. The available water capacity is 9.6 to 10.8 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for dryland crops, windbreaks, and wildlife food and cover.

A representative profile of Mitchell loam, 0 to 6 percent slopes, 395 feet north and 595 feet east of the southwest corner of sec. 7, T. 26 N., R. 60 W.

A1—0 to 3 inches; brown (10YR 5/3) loam, dark brown (10YR 3/3) moist; moderate medium and coarse granular structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; abrupt smooth boundary.

AC—3 to 9 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak medium to coarse prismatic structure parting to weak medium and coarse subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common very fine pores; slightly calcareous; moderately alkaline; clear smooth boundary.

C1—9 to 23 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine pores; calcareous; moderately alkaline; gradual wavy boundary.

C2—23 to 60 inches; light brownish gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; strongly calcareous; moderately alkaline.

Depth to calcareous material ranges from 0 to 5 inches. Accumulations of secondary calcium carbonate commonly do not occur, but some visible accumulations do occur in some profiles. The A1 horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 to 4. The texture ranges from very fine sandy loam to silt loam. This horizon is mildly alkaline to moderately alkaline. The C horizon is loam or silt loam. The reaction is moderately alkaline or strongly alkaline. The C horizon has value of 5 to 7 dry and 4 or 5 moist and chroma of 2 to 4.

19B—Mitchell loam, 0 to 6 percent slopes. This nearly level to undulating soil is on dissected tablelands. It has the profile described as representative of the series. Included in mapping and making up about 10 percent of the acreage are small areas of Bordeaux fine sandy loam, Keota loam, and Otero fine sandy loam.

Runoff is slow to medium, the hazard of erosion is moderate, and the hazard of soil blowing is severe.

This soil is used as range and for windbreaks and wildlife food and cover. Capability unit IVe–3, dryland; Loamy range site; Silty to clayey windbreak site.

19C—Mitchell loam, 6 to 10 percent slopes. This rolling soil is on dissected tablelands. Included in mapping are small areas of Bordeaux fine sandy loam and Keota loam that make up about 6 percent of the acreage.

Runoff is rapid. The hazards of erosion and soil blowing are severe.

This soil is used as range and for windbreaks and wildlife food and cover. Capability unit IVe–3, dryland; Loamy range site; Silty to clayey windbreak site.

19D—Mitchell loam, 10 to 20 percent slopes. This hilly soil is on dissected tablelands (fig. 7). Included in mapping are small areas of Epping loam and Keota loam that make up about 8 percent of the acreage.

Runoff is rapid to very rapid. The hazard of erosion is very severe, and the hazard of soil blowing is severe.

This soil is used as range and for windbreaks and wildlife food and cover. Capability unit VIe–3, dryland; Loamy range site; Silty to clayey windbreak site.

Motoqua series

The Motoqua series consists of shallow, well drained, steep soils on mountainsides. These soils formed in material weathered from granite or other igneous rock. Slopes are 20 to 60 percent. The vegetation is blue grama, bluestem, sideoats grama, prairie threeawn, needleandthread, western wheatgrass, scattered juniper, ponderosa pine, and mountainmahogany.

In a representative profile the surface layer is dark gray very gravelly loam 6 inches thick. The subsoil is dark brown very gravelly clay loam 8 inches thick. Granite bedrock is at a depth of 14 inches.

These soils are moderately permeable. The available water capacity is 1.2 to 1.4 inches. The effective rooting depth is 8 to 20 inches.

These soils are used as limited range and for wildlife food and cover.

A representative profile of Motoqua very gravelly loam, in an area of Motoqua-Rock outcrop complex, 20 to 60 percent slopes, 1,190 feet north and 70 feet east of the southwest corner of sec. 11, T. 28 N., R. 65 W.

A1—0 to 6 inches; dark gray (10YR 4/1) very gravelly loam, very dark gray (10YR 3/1) moist; moderate very fine and fine subangular blocky structure parting to moderate very fine granular; hard, friable, sticky and plastic; 55 percent igneous gravel, cobbles, and stones; mildly alkaline; clear smooth boundary.

B2t—6 to 14 inches; dark brown (10YR 4/3) very gravelly clay loam, dark brown (10YR 3/3) moist; strong fine and medium subangular blocky structure; very hard, firm, sticky and plastic; many moderately thick clay films on peds; common micro and very fine pores; 65 percent igneous gravel, cobbles, and stones; neutral; clear wavy boundary.

IIR—14 inches; granite.

Depth to bedrock ranges from 8 to 20 inches. The content of pebbles, cobbles, and stones ranges from 50 to 75 percent. Of this, about 65 percent is pebbles, 30 percent is cobbles, and 5 percent is stones. The hue is 7.5YR or 10YR. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 1 or 2. The texture of the fine earth

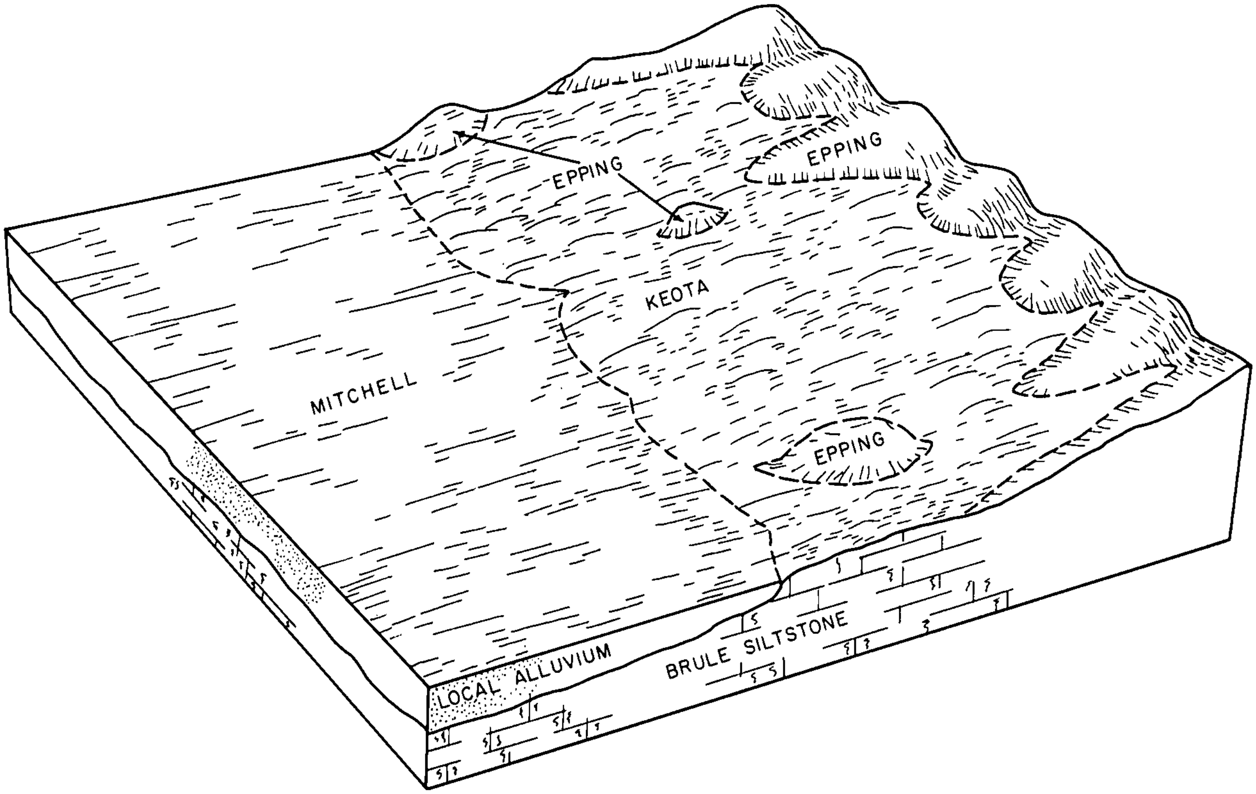

Figure 7.—**Typical landscape and parent material of Mitchell, Epping, and Keota soils.**

fraction ranges from sandy loam to loam, and the horizon is gravelly, very gravelly, cobbly, very cobbly, stony, or very stony. The reaction is neutral or mildly alkaline. The Bt horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture is loam, sandy clay loam, or clay loam. The horizon is gravelly, very gravelly, cobbly, very cobbly, stony or very stony. Clay films occur on peds or as bridges between mineral grains and are thin or moderately thick and patchy or continuous. The Bt horizon is neutral or mildly alkaline.

20F—Motoqua-Rock outcrop complex, 20 to 60 percent slopes. This complex consists of about 40 to 85 percent Motoqua very gravelly loam and 15 to 60 percent Rock outcrop. The Motoqua soil is on mountain side slopes (fig. 8). Rock outcrop occurs as bedrock exposures that are either jagged or smooth and rounded from weathering. The Rock outcrop does not prevent access by livestock except where slopes are steep. Included in mapping and making up about 10 percent of the acreage are small areas of rock slides, Brownrigg very cobbly loam, Willowman gravelly fine sandy loam, and a soil that formed in material that weathered from metamorphic rock dominated by micaceous minerals.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is severe.

This complex is used as range and for wildlife food and cover. Capability unit VIIe-14, dryland; Motoqua part, Shallow igneous range site and Unsuitable windbreak site; Rock outcrop not placed in a range site or windbreak site.

Noden series

The Noden series consists of deep, well drained nearly level to rolling soils on dissected tablelands. These soils formed in eolian sand and in material weathered from noncalcareous sandstone. Slopes are 0 to 10 percent. The vegetation is western wheatgrass, needleandthread, blue grama, threadleaf sedge, and Sandberg bluegrass.

In a representative profile the surface layer is dark grayish brown sandy loam 5 inches thick. The subsoil is brown, dark grayish brown, and pale brown sandy clay loam and sandy loam 15 inches thick. The substratum is pale brown fine sandy loam.

These soils are moderately permeable. The available water capacity is 7.6 to 8.7 inches. The effective rooting depth is 40 to 60 inches.

These soils are used as range and dry cropland and for irrigated crops, windbreaks, and wildlife food and cover.

A representative profile of Noden sandy loam, in an area of Satanta-Noden complex, 0 to 6 percent slopes, 1,450 feet west and 2,640 feet south of the northeast corner of sec. 5, T. 30 N., R. 62 W.

A1—0 to 5 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and nonplastic; neutral; clear smooth boundary.

B1—5 to 9 inches; dark grayish brown (10YR 4/2) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly

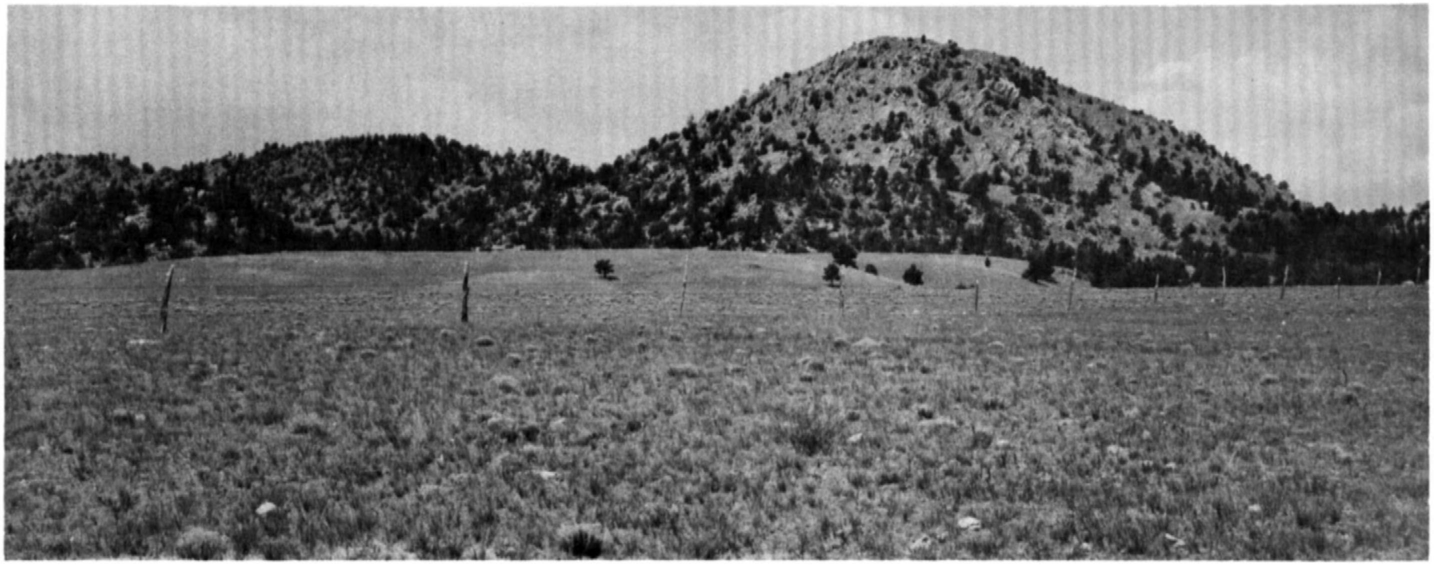

Figure 8.—**Featherlegs-Wolf-Brownrigg complex is in the foreground and extends to the mountain foot slopes. Motoqua very gravelly loam is on the side slopes of the mountains, and outcrops of granitic bedrock are on the peaks and side slopes.**

sticky and nonplastic; common very fine pores; neutral; clear smooth boundary.

B2t—9 to 16 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; strong fine and medium prismatic structure parting to strong fine and medium subangular blocky; very hard, sticky and slightly plastic; many moderately thick clay films as bridges between mineral grains; common very fine pores; neutral; clear smooth boundary.

B3—16 to 20 inches; pale brown (10YR 6/3) sandy loam, dark brown (10YR 4/3) moist; moderate fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; common very fine pores; mildly alkaline; gradual wavy boundary.

C—20 to 60 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; mildly alkaline.

Noncalcareous sandstone occurs between a depth of 40 and 60 inches in some profiles. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. Texture is sandy loam or fine sandy loam. The texture of the B2t horizon ranges from sandy loam to sandy clay loam. The reaction is neutral or mildly alkaline. The C horizon has a value of 6 or 7 dry and 5 or 6 moist. It is neutral to mildly alkaline.

Noden soils are mapped only with Hargreave and Satanta soils.

Otero series

The Otero series consists of deep, well drained, nearly level to sloping soils that formed in loamy calcareous eolian deposits on broad interfluves and in alluvial deposits on fans and foot slopes. Slopes are 0 to 10 percent. The vegetation is blue grama, needleandthread, prairie sandreed, and Indian ricegrass.

In a representative profile the surface layer is grayish brown fine sandy loam 16 inches thick. The underlying material is pale brown and light gray calcareous fine sandy loam (fig. 9).

These soils are rapidly permeable. The available water capacity is 7.8 to 9.0 inches. The effective rooting depth is 60 inches or more.

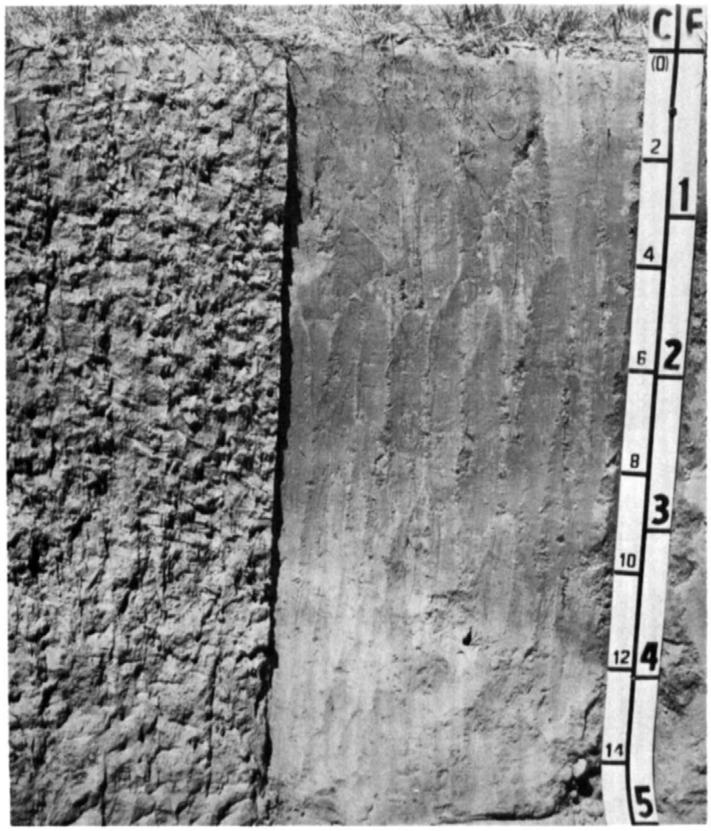

Figure 9.—**Profile of Otero fine sandy loam.**

These soils are used as range and for dryland crops, windbreaks, and wildlife food and cover.

A representative profile of Otero fine sandy loam, 0 to 6 percent slopes, 1,650 feet west and 495 feet south of the northeast corner of sec. 25, T. 26 N., R. 61 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; few micro pores; mildly alkaline; clear smooth boundary.

AC—4 to 16 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; few micro pores; slightly calcareous; moderately alkaline; gradual wavy boundary.

C1—16 to 30 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; common micro pores; calcareous; moderately alkaline; gradual wavy boundary.

C2—30 to 60 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, very friable, slightly sticky and nonplastic; common micro and very fine pores; strongly calcareous; moderately alkaline.

Depth to calcareous material ranges from 0 to 5 inches. Accumulations of secondary calcium carbonate are in some profiles. The A1 horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. The texture is sandy loam or fine sandy loam. The reaction is mildly alkaline or moderately alkaline. The AC horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. The reaction is mildly alkaline or moderately alkaline. The C horizon has value of 4 to 6 moist. The reaction is moderately alkaline or strongly alkaline.

21B—Otero fine sandy loam, 0 to 6 percent slopes. This soil is nearly level to gently sloping on fans and foot slopes and nearly level to undulating on dissected tablelands. This soil has the profile described as representative of the series. Included in mapping and making up about 10 percent of the acreage are areas of Alice fine sandy loam, Dwyer loamy fine sand, Embry soils that have a loamy very fine sand surface layer, and Jayem fine sandy loam.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is severe.

This soil is used as range and for dryland crops, windbreaks, and wildlife food and cover. Capability unit IVe–5, dryland; Sandy range site; Sandy windbreak site.

21C—Otero fine sandy loam, 6 to 10 percent slopes. This sloping soil is on dissected tablelands, fans, and foot slopes. Small areas of Dwyer loamy fine sand, Tassel fine sandy loam, and Otero fine sandy loam that have slopes of 10 to 20 percent are included in mapping and make up about 6 percent of the acreage.

Runoff is medium. The hazard of erosion is moderate to severe, and the hazard of soil blowing is severe.

This soil is used as range and for windbreaks and wildlife food and cover. Capability unit VIe–5, dryland; Sandy range site; Sandy windbreak site.

Rock outcrop

22—Rock outcrop-Tassel complex. This complex consists of about 50 percent Rock outcrop and about 35 percent Tassel fine sandy loam (fig. 10). The Rock outcrop part is made up of exposures of interbedded sandstone and siltstone. The Tassel soil has a profile similar to the one described as representative of the series, except the pebble content may be greater throughout the profile. It is mainly on foot slopes and slopes of erosional remnants and terrace or tableland breaks. Included in mapping are areas of Dix gravelly sandy loam, Epping loam, Keota loam, Mitchell loam, Otero fine sandy loam, and Trelona fine sandy loam that make up about 15 percent of the acreage.

Runoff is rapid to very rapid. The hazard of erosion is severe to very severe and the hazard of soil blowing is very severe.

This complex is used as range and for wildlife food and cover. Some areas are inaccessible to livestock. Capability unit VIIe–14, dryland; Rock outcrop part not placed in a range or windbreak site; Tassel part, Shallow sandy range site; Unsuitable windbreak site.

Rosebud series

The Rosebud series consists of moderately deep, well drained soils that formed in eolian sand and in material that weathered from soft calcareous sandstone. The soils are nearly level to moderately steep on foot slopes and rolling on tablelands. Slopes are 0 to 20 percent. The vegetation is mostly needleandthread, blue grama, and western wheatgrass.

In a representative profile the surface layer is dark grayish brown fine sandy loam 8 inches thick. The subsoil is brown sandy clay loam about 11 inches thick. The substratum, to a depth of 32 inches, is pale brown calcareous fine sandy loam. Below this, it is soft calcareous sandstone.

These soils are moderately permeable, and the available water capacity is 4.3 to 4.9 inches. The effective rooting depth is 20 to 40 inches.

These soils are used as rangeland, dry cropland, and irrigated cropland and for windbreaks and wildlife food and cover.

A representative profile of Rosebud fine sandy loam, in an area of Rosebud-Hargreave fine sandy loams, 0 to 6 percent slopes, 1,385 feet north and 2,180 feet

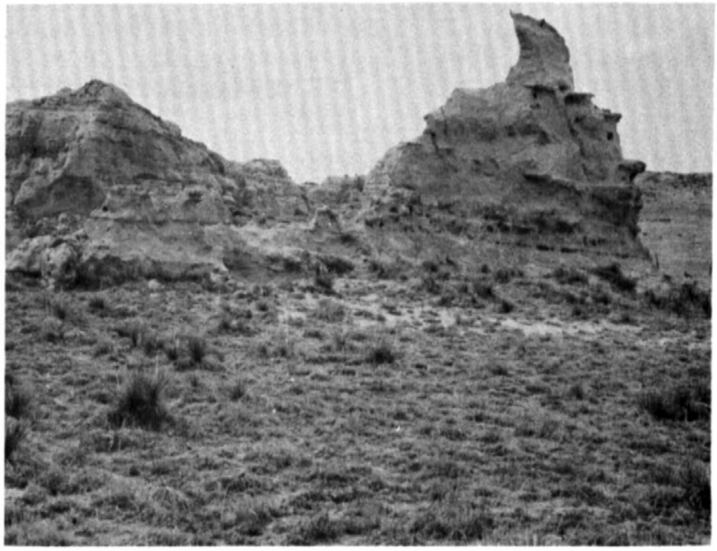

Figure 10.—An area of Rock outcrop-Tassel complex. The Rock outcrop part is made up of exposures of interbedded sandstone and siltstone.

east of the southwest corner of sec. 25, T. 30 N., R. 64 W.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

A12—3 to 8 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B21t—8 to 14 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; strong fine and medium prismatic structure parting to strong fine subangular blocky; very hard, firm, sticky and plastic; many moderately thick clay films as bridging between mineral grains; common micro and very fine pores; mildly alkaline; clear wavy boundary.

B22t—14 to 19 inches; brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; strong fine and medium prismatic structure parting to strong fine and medium subangular blocky; very hard, firm, sticky and plastic; common clay films between mineral grains; common micro and very fine pores; mildly alkaline; gradual wavy boundary.

C1ca—19 to 32 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; hard, firm, slightly sticky and slightly plastic; a few fragments of partly weathered sandstone; slightly calcareous; moderately alkaline; abrupt wavy boundary.

C2r—32 to 36 inches; soft, calcareous, fine-grained sandstone.

The combined thickness of the A and B horizons ranges from 12 to 26 inches, and the depth to carbonates ranges from 10 to 20 inches. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. Texture is fine sandy loam or loam. Reaction is neutral or mildly alkaline. The B2t horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. The texture is loam or sandy clay loam. Within a short distance the Cca horizon may be loam, very fine sandy loam, or fine sandy loam.

23B—Rosebud-Hargreave fine sandy loams, 0 to 6 percent slopes. This complex consists of nearly level and gently sloping soils on dissected tablelands. Areas are about 50 percent Rosebud fine sandy loam and about 35 percent Hargreave fine sandy loam. These soils have the profile described as representative of their series. The Rosebud and Hargreave soils are in similar positions on the landscape. The underlying material in the Rosebud soil is calcareous, and that in the Hargreave soil is noncalcareous. Included in mapping and making up about 15 percent of the acreage are areas of Noden sandy loam, Satanta fine sandy loam, and Trelona fine sandy loam.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is severe.

This complex is used as irrigated pasture and hayland, dry cropland, and rangeland and for windbreaks and wildlife food and cover. Capability units IIIe-5, dryland, and IIe-5, irrigated; Loamy range site; Sandy windbreak site.

23C—Rosebud-Hargreave fine sandy loams, 6 to 10 percent slopes. This complex consists of sloping soils on dissected tablelands. It is about 50 percent Rosebud fine sandy loam and about 40 percent Hargreave fine sandy loam. Rosebud and Hargreave soils are in similar positions on the landscape. The underlying material in the Rosebud soil is calcareous, and that in the Hargreave soil is noncalcareous. Included in mapping and making up about 10 percent of the acreage are areas of Noden sandy loam, Satanta fine sandy loam, and Lambman loam.

Runoff is medium to rapid. The hazards of water erosion and soil blowing are severe.

This complex is used as rangeland and for windbreaks and wildlife food and cover. Capability unit IVe-5, dryland; Loamy range site; Sandy windbreak site.

24B—Rosebud-Trelona fine sandy loams, 0 to 6 percent slopes. This complex consists of nearly level to undulating soils on dissected tablelands. It is about 70 percent Rosebud fine sandy loam and about 20 percent Trelona fine sandy loam. The Rosebud soil is in smooth areas, and the Trelona soil is on low, narrow ridges. Included in mapping are areas of Hargreave sandy loam, Satanta fine sandy loam, and Tassel fine sandy loam that make up about 10 percent of the acreage.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is severe.

This complex is used as range and for dryland crops, irrigated hay and pasture crops, and wildlife food and cover. The Rosebud soil is suited to windbreaks. Capability units IVe-5, dryland, and IIIe-5, irrigated; Rosebud part, Loamy range site and Sandy windbreak site; Trelona part, Shallow sandy range site and Unsuitable windbreak site.

24C—Rosebud-Trelona fine sandy loams, 6 to 10 percent slopes. This complex consists of rolling soils on dissected tablelands. It is about 65 percent Rosebud fine sandy loam and 25 percent Trelona fine sandy loam. These soils have a profile similar to that described as representative of their series. In cultivated fields, however, the original surface layer of the Rosebud soil has been mixed with the subsoil by plowing; in addition, several small areas of light-colored calcareous material have been exposed by erosion. The Rosebud soil is on side slopes, and the Trelona soil is on mounds or narrow ridges. Included in mapping are areas of Hargreave sandy loam, Satanta fine sandy loam, and Tassel fine sandy loam that make up about 10 percent of the acreage.

Runoff is medium. The hazard of erosion is moderate to severe, and the hazard of soil blowing is severe.

This complex is used as range and for dryland crops, irrigated hay and pasture crops, and wildlife food and cover. The Rosebud part of the complex is suited to windbreaks. Capability units IVe-5, dryland, and IIIe-5, irrigated; Rosebud part, Loamy range site and Sandy windbreak site; Trelona part, Shallow sandy range site and Unsuitable windbreak site.

24D—Rosebud-Trelona fine sandy loams, 10 to 20 percent slopes. This complex is on dissected tablelands. It is about 50 percent Rosebud fine sandy loam and 40 percent Trelona fine sandy loam. These soils have a profile similar to the one described as representative of their series. In cultivated fields, however, the original surface layer of the Rosebud soil has been mixed with the subsoil by plowing; in addition, some light-colored, calcareous soil material has been exposed by erosion in several small areas. The Rosebud soil is on side slopes, and the Trelona soil is on hills or narrow ridges. Included in mapping and making up about 10 percent of the acreage are areas of Hargreave sandy loam, Satanta fine sandy loam, Tassel fine sandy loam, and small areas of Sandstone outcrop.

Runoff is rapid. The hazards of erosion and soil blowing are severe.

This complex is used as rangeland and for wildlife food and cover. Capability unit VIe-5, dryland; Rosebud part, Loamy range site and Sandy windbreak site; Trelona part, Shallow sandy range site and Unsuitable windbreak site.

Sandstone outcrop

25—Sandstone outcrop. This mapping unit consists of outcrops of sandstone on terrace breaks and on the steep side slopes of dissected sandy uplands. Some areas of these exposures are so steep or irregular that they are inaccessible to livestock. These outcrops are commonly capped by harder sandstone that varies in thickness and that is calcareous in places. Vegetation is sparse.

Runoff is rapid. The hazards of erosion and soil blowing are severe. Capability unit VIIIs-83, dryland; not assigned to a range site or windbreak site.

Satanta series

The Satanta series consists of deep, well drained, nearly level to sloping soils on terraces, alluvial fans, and foot slopes. These soils formed in eolian deposits and material that weathered from sandstone. Slopes are 0 to 10 percent. The vegetation is needleandthread, western wheatgrass, and blue grama.

In a representative profile the surface layer is dark grayish brown fine sandy loam 3 inches thick. The subsoil is brown, dark grayish brown, and pale brown clay loam and loam 23 inches thick. The substratum is light brownish gray calcareous loam.

These soils are moderately permeable. The available water capacity is 9.8 to 11.0 inches. The effective rooting depth is 60 inches or more.

These soils are used as rangeland and dry cropland and for irrigated crops, windbreaks, and wildlife food and cover.

A representative profile of Satanta fine sandy loam, in the area of Satanta-Noden complex, 0 to 6 percent slopes, 925 feet west and 1,915 feet south of the northeast corner of sec. 1, T. 29 N., R. 64 W.

A1—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure parting to moderate very fine and fine granular; slightly hard, very friable, slightly sticky and slightly plastic; neutral; abrupt smooth boundary.

B1—3 to 9 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common micro pores; mildly alkaline; clear smooth boundary.

B2t—9 to 19 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate medium prismatic structure parting to moderate medium subangular blocky; hard, friable, sticky and plastic; common thin clay films on some peds; many micro pores; mildly alkaline; clear wavy boundary.

B3ca—19 to 26 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate medium subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many micro and very fine pores; slightly calcareous; secondary lime in seams and soft concretions; moderately alkaline; gradual wavy boundary.

Cca—26 to 60 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; calcareous; secondary lime in seams; few micro and very fine pores; moderately alkaline.

In some areas, scattered pebbles are on the surface and mixed throughout the profile. Depth to calcareous materials ranges from 16 to 33 inches. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. Texture ranges from fine sandy loam to loam. This horizon is neutral to mildly alkaline. The B2t horizon has value of 5 through 6 dry and 4 or 5 moist and chroma of 2 through 4. The B2t horizon is heavy loam, sandy clay loam, or clay loam. The B3 horizon is neutral to moderately alkaline. The C horizon has value of 5 to 6 dry and 4 or 5 moist and chroma of 2 or 3. It is moderately alkaline to strongly alkaline.

26B—Satanta-Noden complex, 0 to 6 percent slopes. This complex consists of nearly level to sloping soils on dissected tablelands. It is about 65 percent Satanta fine sandy loam and about 25 percent Noden sandy loam. These soils have the profile described as representative of their series. The Satanta soil is on the summits, foot slopes, and toe slopes, and the Noden soil is on the shoulders and back slopes. Included in mapping and making up about 10 percent of the total acreage are areas of Albinas loam, Hargreave sandy loam, Lambman loam, Manter sandy loam, and Rosebud fine sandy loam.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is severe.

This complex is used as range and for dryland crops, windbreaks, and wildlife food and cover. Capability unit IIIe-5, dryland; Loamy range site; Sandy windbreak site.

26C—Satanta-Noden complex, 6 to 10 percent slopes. This complex consists of sloping soils on dissected tablelands. It is about 60 percent Satanta fine sandy loam and about 30 percent Noden sandy loam. The Satanta soil is on foot slopes and toe slopes, and the Noden soil is on the shoulders and back slopes. Included in mapping and making up about 10 percent of the acreage are areas of Rosebud fine sandy loam and Trelona fine sandy loam.

Runoff is medium to rapid. The hazards of erosion and soil blowing are severe.

This complex is used as range and for dryland crops, windbreaks, and wildlife food and cover. Capability unit IVe-5, dryland; Loamy range site; Sandy windbreak site.

27D—Satanta-Willowman-Lambman complex, 3 to 20 percent slopes. This complex consists of undulating to hilly soils on dissected tablelands (figs. 11 and 12). It is about 35 percent Satanta loam, 25 percent Willowman gravelly fine sandy loam, and about 25 percent Lambman loam. Lambman and Willowman soils have the profile described as representative of their series. The Satanta soil is on toe slopes. The Willowman soil is on back slopes and foot slopes. The Lambman soil is on shoulder slopes and summits. Included in map-

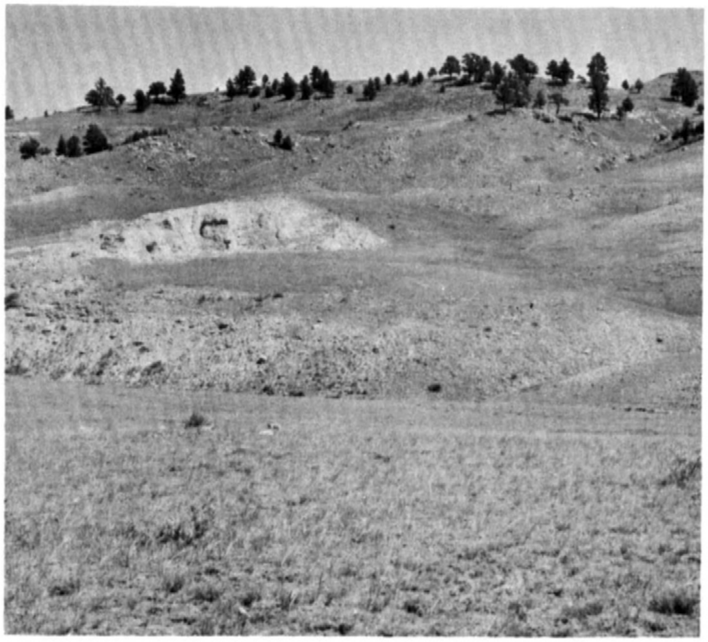

Figure 11.—Satanta soils are on the bottom lands. Willowman soils are on the side slopes and back slopes, and Lambman soils are on the shoulder slopes and upland summit areas.

ping and making up about 15 percent of the acreage are areas of Wolf loam, Brownrigg cobbly loam, Featherlegs loam, Lambman loam, Rosebud fine sandy loam, and small areas of sandstone outcrop.

Runoff is medium to rapid. The hazard of erosion is moderate to severe, and the hazard of soil blowing is severe.

This complex is used as range and for windbreaks and wildlife food and cover. Capability unit VIe-5, dryland; Satanta part, Loamy range site and Sandy windbreak site; Willowman part, Coarse upland range site and Sandy windbreak site; Lambman part, Shallow loamy range site and Unsuitable windbreak site.

Tassel series

The Tassel series consists of shallow, well drained soils that formed in material weathered from calcareous sandstone. These soils are undulating to hilly on dissected uplands that merge with tablelands. Slopes are 3 to 20 percent. The vegetation is blue grama, prairie sandreed, threadleaf sedge, green needlegrass, needleandthread, and yucca.

In a representative profile the surface layer is grayish brown fine sandy loam 4 inches thick. The next layer is pale brown fine sandy loam 4 inches thick. The underlying material, to a depth of 16 inches, is pale

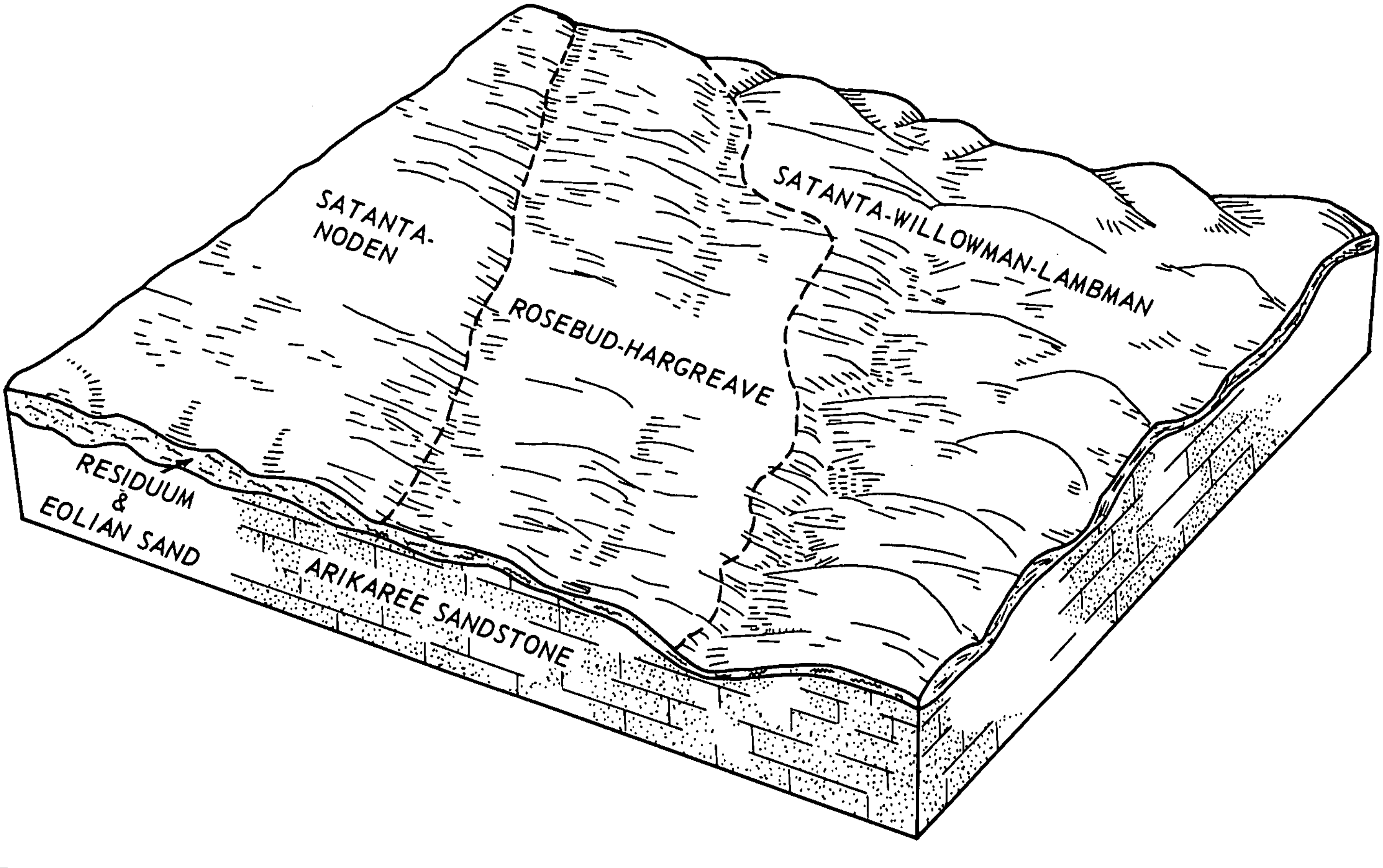

Figure 12.—Typical landscape and parent material of Satanta-Noden soils, Rosebud-Hargreave soils, and Satanta-Willowman-Lambman soils.

brown fine sandy loam. Below this it is soft sandstone.

This soil has moderately rapid permeability. The available water capacity is 2.0 to 2.4 inches. The effective rooting depth is 12 to 18 inches.

These soils are used as range and for wildlife food and cover.

A representative profile of Tassel fine sandy loam, in an area of Dwyer-Valent-Tassel complex, 3 to 20 percent slopes, 990 feet west and 1,980 feet south of the northeast corner of sec. 7, T. 28 N., R. 62 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; slightly calcareous; moderately alkaline; clear smooth boundary.

AC—4 to 8 inches; pale brown (10YR 6/3) fine sandy loam, dark brown (10YR 4/3) moist; weak medium and coarse subangular blocky structure parting to weak fine and medium granular; slightly hard, very friable, slightly sticky and slightly plastic; few micro pores; strongly calcareous; moderately alkaline; gradual wavy boundary.

C1—8 to 16 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; few micro pores; 15 percent sandstone gravel; strongly calcareous; moderately alkaline; gradual wavy boundary.

C2r—16 to 20 inches; soft, calcareous sandstone.

The depth to bedrock ranges from 12 to 18 inches. The top one or two inches of the surface layer is leached of carbonates in places. The A1 horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to loamy fine sand. The AC horizon has value of 5 or 6 dry and 4 or 5 moist and chroma of 2 or 3. The C1 horizon has value of 6 or 7 dry and 4 or 5 moist and chroma of 2 or 3.

This soil is mapped only with Dwyer and Valent soils and Rock outcrop.

Torrifluvents

28—Torrifluvents-Fluvaquents complex. This complex consists of about 55 percent Torrifluvents and about 35 percent Fluvaquents. Torrifluvents consist of well drained and moderately well drained soils on low terraces. They are composed of stratified, water-deposited material that has variable texture and shows little or no horizon development. They are on the first terrace above the flood plain along major drainageways. They are flooded occasionally but not for long periods. Torrifluvents are calcareous or noncalcareous and coarse textured to moderately fine textured.

The Fluvaquents are somewhat poorly drained soils on flood plains. They have moderately fine textured to coarse textured strata that resulted from the sediments deposited under changing currents and shifting channels. They have a fluctuating water table. A variety of water-tolerant plants grow on these soils. Included in mapping and making up about 10 percent of the acreage are small areas of saline soils.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is moderate.

These soils are used as rangeland and native hayland and for wildlife food and cover. The Torrifluvents are used for irrigated hay and small grain and for dryland crops. Capability unit IVw–63, dryland; IIIw–63, irrigated; Subirrigated range site; Moderately wet windbreak site.

29—Torrifluvents-Fluvaquents complex, saline. This complex consists of about 55 percent Torrifluvents and about 40 percent Fluvaquents. The Torrifluvents are on first terraces above stream bottoms and in areas where there is no water table. They flood occasionally but not for long periods, and they are strongly alkaline, calcareous, or salty. Texture varies from moderately fine to coarse.

The Fluvaquents consist of poorly drained soils on the flood plains. They have a fluctuating water table and a saline surface layer. These soils vary in texture and show little or no horizon development. Included in mapping and making up about 5 percent of the acreage are small areas of nonsaline soils.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is severe.

These soils are used as rangeland and native hayland and for wildlife food and cover. In some areas the Torrifluvents are used for irrigated hay. Capability units VIws–10, dryland; VIws–10, irrigated; Saline subirrigated range site; Unsuitable windbreak site.

Torriorthents

30—Torriorthents, gullied. This unit consists of about 50 percent Torriorthents and 45 percent gullies. The Torriorthents are deep to moderately deep, friable soils that show little or no horizon development. These soils are gently sloping to sloping and occur in areas between gullies and on the bottoms and in the outwash areas of large gullies. The gullied areas consist either of a single large gully or of a network of large or small gullies in places where the original soil has almost been destroyed. A few of these gullies have stabilized, and some have partially stabilized sides. But most of the gullies are still active at the head. Included in mapping are small areas of siltstone and sandstone bedrock that make up about 5 percent of the acreage.

Runoff is rapid. The hazard of erosion is severe, and the hazard of soil blowing is moderate.

The soils in this mapping unit are used as range and for wildlife food and cover. Capability unit VIIe–82, dryland; Sandy range site; Sandy windbreak site.

Trelona series

The Trelona series consists of shallow, well drained soils that formed in material weathered from noncalcareous sandstone. They are undulating to hilly on dissected uplands which merge with the tablelands. Slopes are 3 to 20 percent. The vegetation is blue grama, needleandthread, and threadleaf sedge.

In a representative profile the surface layer is dark grayish brown fine sandy loam 7 inches thick. The underlying material, to a depth of 14 inches, is brown fine sandy loam. Below this, it is noncalcareous sandstone.

These soils have moderately rapid permeability. The available water capacity is 1.8 to 2.1 inches. The effective rooting depth is 10 to 20 inches.

These soils are used as range and for wildlife food and cover.

A representative profile of Trelona fine sandy loam, in an area of Jayem-Trelona-Manter complex, 3 to 20 percent slopes, 2,155 feet east and 1,650 feet north of the southwest corner of sec. 8, T. 29 N., R. 60 W.

A1—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; many micro pores; mildly alkaline; gradual smooth boundary.

C1—7 to 14 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium and coarse prismatic structure parting to weak fine and medium subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many micro pores; 10 percent sandstone pebbles; mildly alkaline; clear wavy boundary.

C2r—14 to 18 inches; soft, noncalcareous sandstone.

The depth to bedrock ranges from 10 to 20 inches. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to loamy fine sand. The C1 horizon has value of 4 to 6 dry and 3 to 5 moist and chroma of 2 or 3.

Trelona soils are mapped only with Jayem, Manter, and Rosebud soils.

Ustic Torrifluvents

31—Ustic Torrifluvents, undulating. This unit consists of light-colored, deep to moderately deep, friable soils. They are calcareous or noncalcareous, and in most places they have stratified layers of moderately coarse textured material. These soils are on flood plains in the upper part of the major drainageways and in intermittent secondary drainageways. In some places, they have uniform texture throughout and do not have stratified layers. In other places, they consist mainly of sand and gravel.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is moderate.

These soils are used as rangeland and for wildlife food and cover. Capability unit VIIs-6, dryland; Sandy lowland range site; Sandy windbreak site.

Valent series

The Valent series consists of deep, excessively drained soils that formed in noncalcareous eolian sand. The soils are nearly level to sloping where they occur on wind-reworked alluvial deposits and dissected uplands; they are rolling to steep where they occur in dunelike areas. Slopes are 0 to 40 percent. The vegetation is prairie sandreed, blue grama, and needleandthread.

In a representative profile the surface layer is grayish brown fine sand about 4 inches thick. The next layer is brown fine sand 18 inches thick. The underlying material is pale brown fine sand.

These soils have very rapid permeability. The available water capacity is 3.0 to 4.2 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for irrigated crops and wildlife food and cover.

A representative profile of Valent fine sand, in an area of Valent-Dwyer loamy fine sands, 0 to 3 percent slopes, 1,960 feet north and 1,855 feet west of the southwest corner of sec. 14, T. 25 N., R. 61 W.

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose, nonsticky and nonplastic; mildly alkaline; clear smooth boundary.

AC—4 to 22 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose, nonsticky and nonplastic; mildly alkaline; gradual wavy boundary.

C—22 to 60 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose, nonsticky and nonplastic; mildly alkaline.

Depth to calcareous material is more than 40 inches. The gravel content is 2 to 6 percent. The A1 horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 or 3. The AC horizon has value of 5 or 6 dry and 3 or 4 moist and chroma of 2 or 3. The C horizon has value of 6 or 7 dry and 5 or 6 moist and chroma of 2 or 3.

32D—Valent-Dwyer fine sands, rolling. This complex consists of about 45 percent Valent fine sand and 45 percent Dwyer fine sand. These rolling soils occupy similar positions on a dissected landscape that extends to the hilly, dunelike, sandy uplands. Included in mapping and making up about 10 percent of the acreage are areas of Dailey loamy fine sand, Dwyer loamy fine sand, Otero fine sandy loam, Valent loamy fine sand, Vetal fine sandy loam, and Dune land.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is very severe.

These soils are used as range and for windbreaks and wildlife food and cover. Capability unit VIe-15, dryland; Sands range site; Very sandy windbreak site.

32E—Valent-Dwyer fine sands, hilly. This complex consists of about 45 percent Valent fine sand and 45 percent Dwyer fine sand. These soils are in hilly, dunelike areas on sandy uplands. Included in mapping and making up about 10 percent of the acreage are areas of Dailey loamy fine sand, Dune land, Dwyer loamy fine sand, and Valent loamy fine sand.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is very severe.

These soils are used as range and for windbreaks and wildlife food and cover. Capability unit VIIe-15, dryland; Choppy sands range site; Very sandy windbreak site.

33A—Valent-Dwyer loamy fine sands, 0 to 3 percent slopes. This complex consists of about 45 percent Valent loamy fine sand and 45 percent Dwyer loamy fine sand. These soils have the profile described as representative of their series. They are nearly level and occupy similar positions on the landscape. They occur on alluvial deposits reworked by wind and on toe slopes of dissected uplands. Included in mapping and making up about 10 percent of the acreage are areas of Alice fine sandy loam, Dailey loamy fine sand, Embry fine sandy loam, Jayem fine sandy loam, and Otero fine sandy loam.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is very severe.

These soils are used as range and for irrigated crops, windbreaks, and wildlife food and cover. Capability unit IVe-4, dryland; IIIe-4, irrigated; Sandy range site; Very sandy windbreak site.

33C—Valent-Dwyer loamy fine sands, 3 to 10 percent slopes. This complex consists of about 45 percent Dwyer loamy fine sand and 45 percent Valent loamy fine sand. These soils occupy similar positions on the landscape. They are on dissected foot slopes along drainageways and in the sandy uplands. Included in mapping and making up about 10 percent of the acreage are areas of Dailey loamy fine sand, Embry fine sandy loam, Otero fine sandy loam, Valent fine sand, and Dwyer fine sand.

Runoff is slow to medium. The hazard of erosion is slight to moderate, and the hazard of soil blowing is very severe.

These soils are used as range and for irrigated crops, windbreaks, and wildlife food and cover. Capability unit VIe–4, dryland; IVe–4, irrigated; Sandy range site; Very sandy windbreak site.

Vetal series

The Vetal series consists of deep, well drained, nearly level to sloping soils in drainageways and on toe slopes. These soils formed in alluvium from noncalcareous sandstone and eolian sand. Slopes are 0 to 10 percent. The vegetation is needleandthread, blue grama, threadleaf sedge, Indian ricegrass, and fringed sagewort.

In a representative profile the surface layer is brown and dark grayish brown fine sandy loam 16 inches thick. The next layer is brown fine sandy loam 8 inches thick. The underlying material is light brownish gray fine sandy loam.

These soils have moderately rapid permeability. The available water capacity is 7.8 to 9.0 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for irrigated and dryland crops, windbreaks, and wildlife food and cover.

A representative profile of Vetal fine sandy loam, 0 to 6 percent slopes, 265 feet east and 265 feet north of the southwest corner of sec. 8, T. 29 N., R. 60 W.

A11—0 to 5 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure parting to weak very fine and fine granular; soft, very friable, slightly sticky and slightly plastic; many micro pores; neutral; clear smooth boundary.

A12—5 to 16 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak coarse prismatic structure parting to moderate medium and coarse subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; many micro pores; mildly alkaline; clear smooth boundary.

AC—16 to 24 inches; brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium and coarse subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; many micro pores; mildly alkaline; gradual wavy boundary.

C—24 to 60 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; many micro pores; mildly alkaline.

The content of pebbles is 5 to 10 percent in places. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from loamy fine sand to very fine sandy loam. The AC horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The C horizon has value of 5 to 7 dry and 4 or 5 moist and chroma of 2 or 3.

34B—Vetal fine sandy loam, 0 to 6 percent slopes. This nearly level to gently sloping soil is in drainageways and on alluvial fans and toe slopes of dissected sandy uplands and tablelands. It has the profile described as representative of the series. Included in mapping and making up about 5 percent of the acreage are small areas of Alice fine sandy loam, Dailey loamy fine sand, and Jayem fine sandy loam.

Runoff is slow. The hazard of erosion is slight, and the hazard of soil blowing is severe.

This soil is used as range and for irrigated and dryland crops, windbreaks, and wildlife food and cover. Capability unit IIIe–5, dryland; IIe–5, irrigated; Sandy range site; Sandy windbreak site.

34C—Vetal fine sandy loam, 6 to 10 percent slopes. This sloping soil is on toe slopes and foot slopes of dissected uplands and tablelands. Included in mapping are small areas of Alice fine sandy loam, Dailey loamy fine sand, Jayem fine sandy loam, and Manter sandy loam that make up about 10 percent of the acreage.

Runoff is medium. The hazard of erosion is moderate, and the hazard of soil blowing is severe.

This soil is used as range and for irrigated and dryland crops, windbreaks, and wildlife food and cover. Capability unit IVe–5, dryland; IIIe–5, irrigated; Sandy range site; Sandy windbreak site.

Wendover series

The Wendover series consists of shallow, well drained, moderately steep to steep soils on mountainsides. These soils formed in materials weathered from limestone and sandstone. Slopes are 10 to 60 percent. The vegetation is bluestem, blue grama, western wheatgrass, sideoats grama, needleandthread, threadleaf sedge, mountainmahogany, and scattered juniper and ponderosa pine.

In a representative profile, the surface layer is dark grayish brown very cobbly fine sandy loam 4 inches thick. The subsoil is dark grayish brown very cobbly loam 6 inches thick. The substratum is very pale brown very cobbly sandy loam underlain by limestone bedrock at a depth of 18 inches.

These soils have moderately rapid permeability. The available water capacity is 1.2 to 1.4 inches. The effective rooting depth is 7 to 20 inches.

These soils are used as limited range and for wildlife food and cover.

A representative profile of Wendover very cobbly fine sandy loam, in an area of Wendover-Rock outcrop complex, 10 to 60 percent slopes, 2,310 feet east and 265 feet south of the northwest corner of sec. 11, T. 30 N., R. 65 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) very cobbly fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium granular structure; slightly hard, very friable, slightly sticky and slightly plastic; 55 percent sedimentary gravel, cobbles, and stones; slightly calcareous; mildly alkaline; gradual wavy boundary.

B2t—4 to 10 inches; dark grayish brown (10YR 4/2) very cobbly loam, very dark grayish brown (10YR 3/2) moist; moderate very fine and fine subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few thin clay films; 65 percent sedimentary gravel, cobbles, and stones; strongly calcareous; moderately alkaline; clear smooth boundary.

Cca—10 to 18 inches; very pale brown (10YR 7/3) very cobbly sandy loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; 80 percent sedimentary gravel, cobbles, and stones; strongly calcareous; moderately alkaline; clear wavy boundary.

R—18 to 22 inches; limestone.

The depth to bedrock ranges from 7 to 20 inches. The content of gravel, cobbles, and stones ranges from 55 to 80 percent. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to loam and is gravelly, very gravelly, cobbly, very cobbly, stony, or very stony. Reaction is mildly or moderately alkaline, and the horizon is slightly calcareous to strongly calcareous. The B2t horizon has hue of 7.5YR or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 2 or 3. The texture is loam, sandy clay loam, or clay loam and is gravelly, very gravelly, cobbly, very cobbly, stony, or very stony in places. Reaction is mildly alkaline or moderately alkaline. The horizon is slightly calcareous to strongly calcareous. Clay films occur on peds or as bridges between mineral grains and are thin or moderately thick and patchy or continuous. The C horizon has value of 6 or 8 dry and 4 to 6 moist and chroma of 2 to 4. The texture ranges from sandy loam to clay loam and is gravelly, very gravelly, cobbly, very cobbly, stony or very stony in places. The C horizon is moderately alkaline or strongly alkaline and slightly calcareous to strongly calcareous.

35F—Wendover-Rock outcrop complex, 10 to 60 percent slopes. This complex consists of about 60 to 70 percent Wendover very cobbly fine sandy loam and 15 to 35 percent Rock outcrop (fig. 13). The Wendover soil is moderately steep and steep on mountain side slopes. The Rock outcrop is exposed bedrock that in most places has been smoothed and rounded by weathering; nevertheless, it prevents livestock from grazing certain areas. Included in mapping and making up 5 to 15 percent of the acreage are small areas of soils that formed in material that weathered from red sandstone, calcareous shale, and other sedimentary rocks. Also included are areas of Brownrigg cobbly loam, of Willowman gravelly fine sandy loam, and of rock slides.

Runoff is medium to rapid. The hazard of erosion is moderate to severe, and the hazard of soil blowing is severe.

This complex is used as range and for wildlife food and cover. Capability unit VIIe-14, dryland; Wendover soil, Shallow loamy range site and Unsuitable windbreak site. Rock outcrop not placed in a range site or windbreak site.

Willowman series

The Willowman series consists of deep, well drained, gently sloping to moderately steep soils on mountain toe slopes and foot slopes. These soils formed in colluvium or eolian sand. Slopes are 3 to 20 percent. The vegetation is Sandberg bluegrass, bluestem, western wheatgrass, blue grama, threadleaf sedge, needleandthread, and yucca.

In a representative profile the surface layer is brown gravelly fine sandy loam 5 inches thick (fig. 14). The subsoil is brown gravelly sandy clay loam 8 inches thick. The substratum, to a depth of 60 inches, is brown and light gray very gravelly sandy loam.

These soils are moderately permeable. The available water capacity is 3.5 to 4.0 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for wildlife food and cover.

A representative profile of Willowman gravelly fine sandy loam, in an area of Satanta-Willowman-Lambman complex, 3 to 20 percent slopes, 1,650 feet north and 330 feet east of the southwest corner of sec. 24, T. 30 N., R. 65 W.

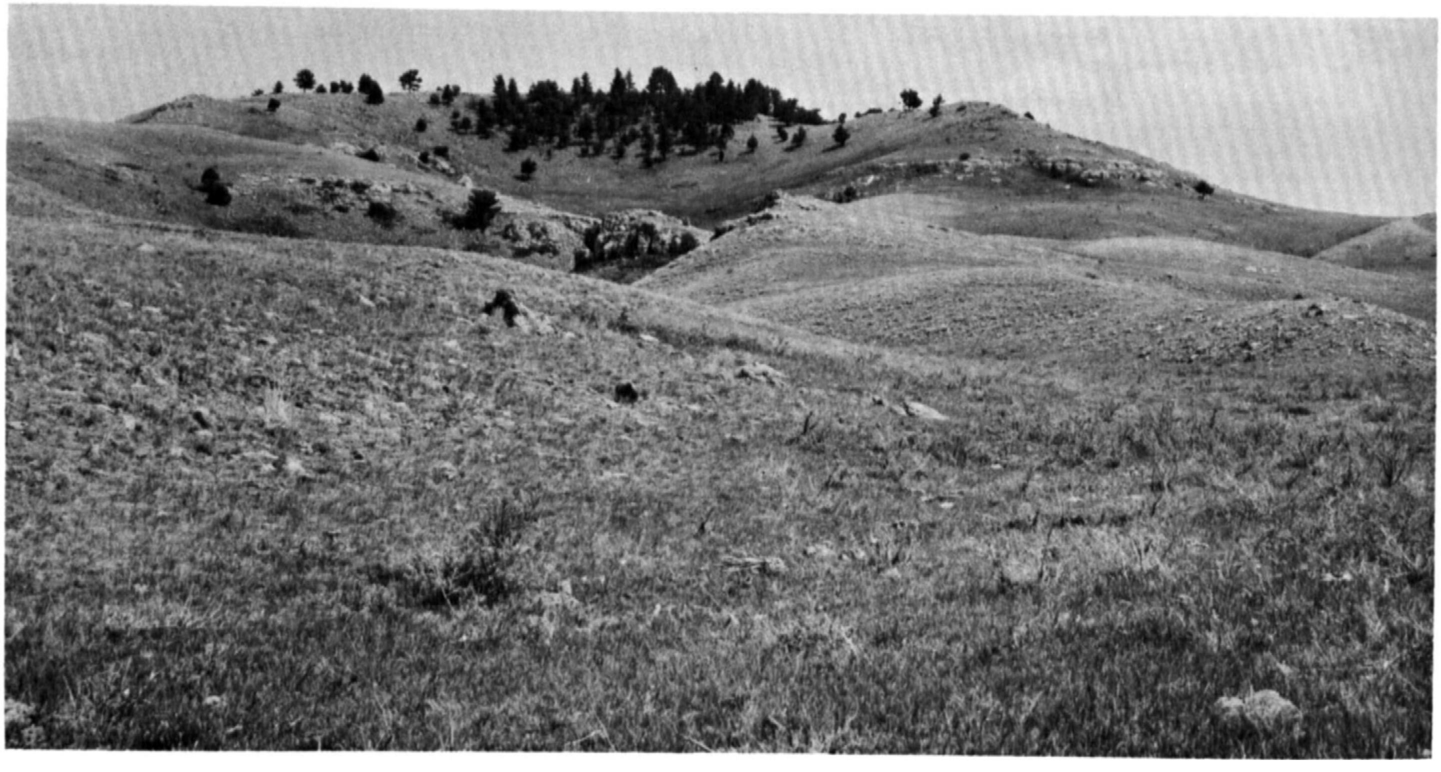

Figure 13.—Wendover very cobbly fine sandy loam is on the mountain side slopes. The Rock outcrop is limestone.

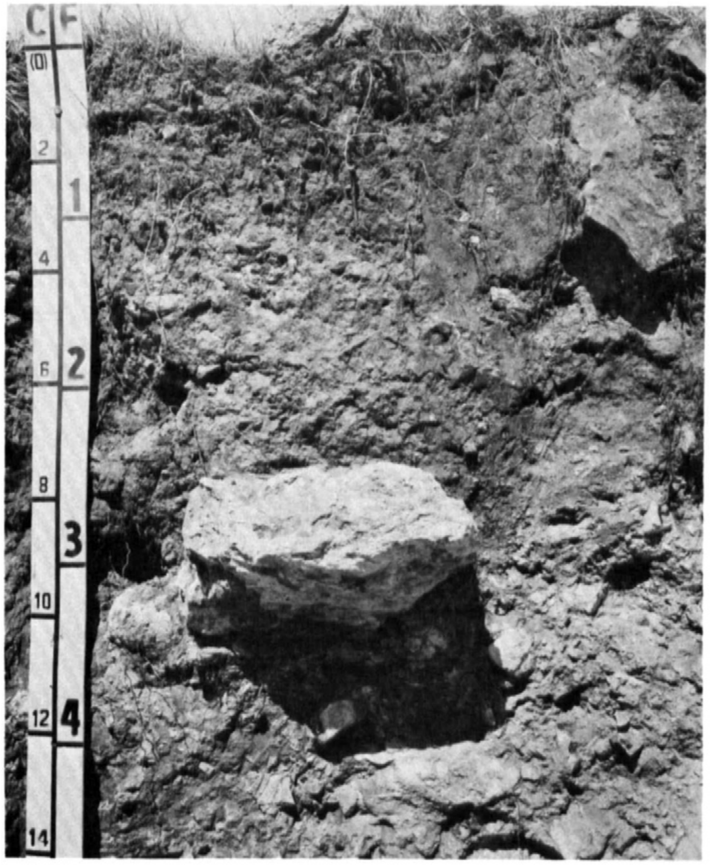

***Figure 14.*—Profile of Willowman gravelly fine sandy loam. In this soil the content of rock fragments ranges from 35 to 70 percent.**

A1—0 to 5 inches; brown (10YR 4/3) gravelly fine sandy loam, dark brown (10YR 3/3) moist; weak fine and medium granular structure; soft, very friable, slightly sticky and slightly plastic; 35 percent gravel, cobbles, and stones; mildly alkaline; clear smooth boundary.

B2t—5 to 13 inches; brown (7.5YR 4/2) gravelly sandy clay loam, dark brown (7.5YR 3/2) moist; moderate medium and coarse subangular blocky structure; hard, friable, sticky and plastic; common moderately thick clay films; 35 percent gravel, cobbles, and stones; mildly alkaline; gradual wavy boundary.

C1—13 to 29 inches; brown (7.5YR 5/2) very gravelly sandy loam, dark brown (7.5YR 4/2) moist; weak fine and medium subangular blocky structure; slightly hard, firm, slightly sticky and slightly plastic; 70 percent gravel, cobbles, and stones; moderately alkaline; gradual wavy boundary.

C2ca—29 to 60 inches; light gray (10YR 7/2) very gravelly sandy loam, light brownish gray (10YR 6/2) moist; massive; slightly hard, firm, slightly sticky and slightly plastic; 70 percent gravel, cobbles, and stones; strongly calcareous; moderately alkaline.

The depth to carbonates ranges from 7 to 30 inches. The soil material in some places is gravelly, very gravelly, cobbly, very cobbly, stony or very stony. The content of rock fragments ranges from 35 to 70 percent. The hue ranges from 5YR to 10YR. The A1 horizon has value of 4 to 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to loam. The B2t horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to sandy clay loam. Clay films occur on some peds, but they generally are bridges between mineral grains. The clay films are thin or moderately thick and patchy or continuous. The C horizon has chroma of 2 or 3. The texture ranges from loam to sandy loam. Reaction is moderately or strongly alkaline. The Cca horizon ranges to strongly calcareous.

Willowman soils are mapped only with Lambman and Satanta soils.

Wolf series

The Wolf series consists of deep, well drained, nearly level to hilly soils on terraces, fans, pediments, and mountain foot slopes. These soils formed in calcareous, gravelly, old alluvial sediments. Slopes are 0 to 20 percent. The vegetation is western wheatgrass, blue grama, needleandthread, threadleaf sedge, Sandberg bluegrass, and big sagebrush.

In a representative profile the surface layer is dark grayish brown loam 4 inches thick (fig. 15). The subsoil is brown and light brownish gray clay loam 14 inches thick. The substratum is light gray calcareous clay loam to a depth of 37 inches. Below that, it is light brownish gray very gravelly sandy loam.

These soils are moderately permeable. The available water capacity is 6.9 to 7.6 inches. The effective rooting depth is 60 inches or more.

These soils are used as range and for dryland crops, windbreaks, and wildlife food and cover.

A representative profile of Wolf loam, in an area of

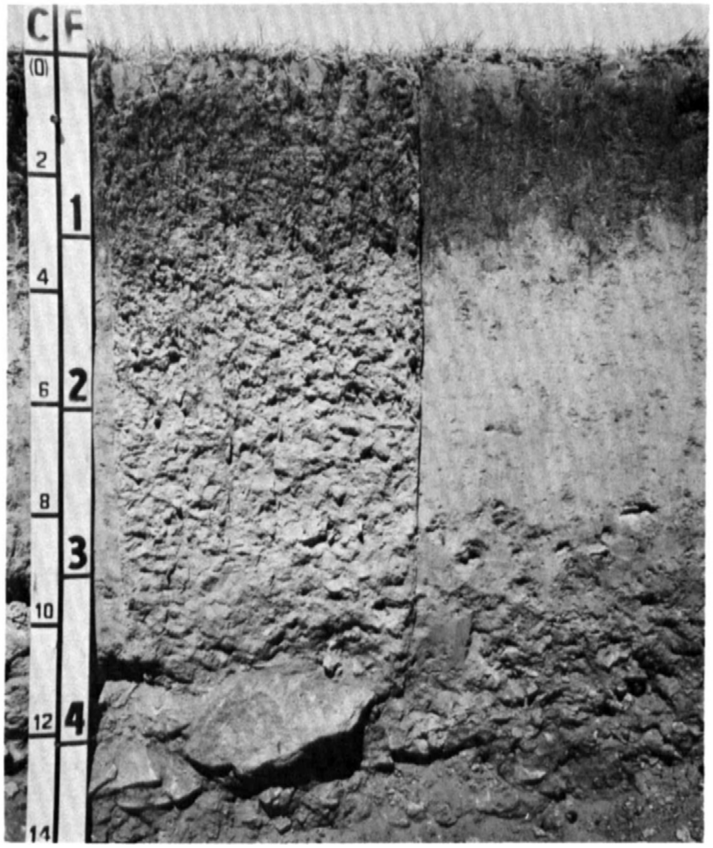

***Figure 15.*—Profile of Wolf loam.**

Featherlegs-Wolf loams, 0 to 6 percent slopes, 1,518 feet south and 1,584 feet west of the northeast corner of sec. 17, T. 30 N., R. 64 W.

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium and coarse granular structure; slightly hard, very friable, slightly sticky and slightly plastic; mildly alkaline; clear smooth boundary.

B2t—4 to 13 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; strong fine and coarse subangular blocky structure; hard, firm, sticky and plastic; many moderately thick clay films; mildly alkaline; clear wavy boundary.

B3ca—13 to 18 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate fine and coarse subangular blocky structure; hard, firm, sticky and plastic; many moderately thick clay films; calcareous; moderately alkaline; clear wavy boundary.

C1ca—18 to 37 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; moderate fine and coarse subangular blocky structure; hard, firm, sticky and plastic; strongly calcareous; strongly alkaline; clear wavy boundary.

IIC2—37 to 60 inches; light brownish gray (10YR 6/2) very gravelly sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; strongly calcareous; 65 percent gravel and cobbles; moderately alkaline.

The depth to calcareous material ranges from 4 to 12 inches. The content of coarse fragments in the A and B horizons ranges from 0 to 15 percent. The A1 horizon has value of 4 or 5 dry and 2 or 3 moist and chroma of 2 or 3. The texture ranges from fine sandy loam to loam. The reaction is neutral or mildly alkaline. The texture of B2t horizon is loam, sandy clay loam, or clay loam. This horizon has value of 4 or 5 dry and 3 or 4 moist and chroma of 2 or 3. Clay films occur on peds or as bridges between the mineral grains, are moderately thick or thick, and are continuous. The C horizon has value of 6 or 7 dry and 5 or 6 moist and chroma of 2 or 3. The texture ranges from loam to clay loam. In the IIC horizon the content of pebbles and cobbles ranges from 55 to 75 percent and there are a few stones.

Wolf soils are mapped only with Featherlegs and Brownrigg soils.

Use and management of the soils

This section discusses the use of the soils as rangeland and for crops, windbreaks, and wildlife habitat and use in engineering.

Crops

This section discusses the capability classification system used by the Soil Conservation Service and the application of the system in this survey area. It also discusses management of dry cropland soils and management of irrigated soils. In addition, this section contains a brief discussion of estimated yields and a table showing the yields of major crops that can be expected under two levels of management.

Both dryland farming and irrigated farming are practiced in the survey area, and each capability unit is designated as either dryland or irrigated. Soils that are farmed partly as dryland and partly under irrigation are placed in two capability units. Albinas loam, 0 to 6 percent slopes, for example, is in capability unit IIIe-2, dryland, and IIe-2, irrigated. The capability classification of each mapped soil can be found in the "Guide to mapping units."

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering purposes.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These levels are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use.

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils of class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

A description of the capability units in the northern part of Goshen County follows. The capability units are not numbered consecutively, because the grouping is statewide and not all the capability units in the state are represented in the survey area.

Class I soils have few limitations that restrict their use. (None in this survey area.)

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

- Subclass IIe. Soils are subject to moderate erosion if they are cultivated and not protected.
  - Irrigated unit IIe-2.—Deep, well drained, medium textured, very gently sloping soils on uplands and in upland swales and shallow drainageways.
  - Irrigated unit IIe-5.—Deep, well drained, moderately coarse textured, nearly level and very gently sloping soils on uplands, foot slopes, terraces, and flood plains.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

- Subclass IIIe. Soils are subject to severe erosion if they are cultivated and not protected.
  - Dryland unit IIIe-2.—Deep and moderately deep, well drained, medium textured, nearly level and gently sloping soils on uplands and in swales and shallow drainageways.
  - Dryland unit IIIe-5.—Deep and moderately deep, well drained, moderately coarse textured, nearly level and gently sloping soils on uplands, fans, foot slopes, and flood plains.
  - Irrigated unit IIIe-4.—Deep, excessively drained, coarse textured, nearly level and very gently sloping soils on uplands, fans, and flood plains.
  - Irrigated unit IIIe-5.—Deep and moderately deep, well drained, moderately coarse textured, nearly level to moderately steep soils on uplands, fans, and foot slopes.
- Subclass IIIs. Soils have limitations caused by texture.
  - Irrigated unit IIIs-4.—Deep, excessively drained, coarse textured, nearly level and very gently sloping soils on uplands, fans, and flood plains.
- Subclass IIIw. Soils have limitations caused by frequent flooding or a fluctuating water table.
  - Irrigated unit IIIw-63.—Predominantly deep, somewhat poorly drained, nearly level and gently sloping soils on flood plains and in upland depressions.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

- Subclass IVe. Soils are subject to severe erosion if they are cultivated and not protected.
  - Dryland unit IVe-2.—Deep and moderately deep, well drained, medium textured, sloping soils on uplands.
  - Dryland unit IVe-3.—Deep and moderately deep, well drained, medium textured, nearly level to sloping soils on uplands, fans, and foot slopes.
  - Dryland unit IVe-4.—Deep, excessively drained, nearly level to very gently sloping soils on uplands, fans, and flood plains.
  - Dryland unit IVe-5.—Deep and moderately deep, well drained, moderately coarse textured, nearly level to sloping soils on uplands, fans, terraces, and flood plains.
  - Irrigated unit IVe-4.—Deep, excessively drained, coarse textured, gently sloping to sloping soils on uplands, fans, foot slopes, and flood plains.
- Subclass IVw.—Soils which are frequently flooded or that have a fluctuating water table.
  - Dryland unit IVw-63.—Predominantly deep, somewhat poorly drained, nearly level to gently sloping soils on flood plains and in upland depressions.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat. (None in survey area.)

Class VI soils have severe limitations which make them generally unsuited to cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

- Subclass VIe.—Soils subject to severe erosion unless properly managed.
  - Dryland unit VIe-3.—Deep, well drained, medium textured soils that have a high content of lime.
  - Dryland unit VIe-4.—Deep, excessively drained, coarse textured, gently sloping to steep soils on uplands, fans, foot slopes, and flood plains.
  - Dryland unit VIe-5.—Deep and moderately deep, well drained, moderately coarse textured, undulating to moderately steep soils on uplands, fans, and foot slopes.
  - Dryland unit VIe-14.—Shallow, well drained, medium textured, very gently sloping to sloping soils on uplands.
  - Dryland unit VIe-15.—Deep, excessively drained, coarse textured, nearly level to moderately steep soils on uplands.
- Subclass VIs.—Soils which have severe limitations because of low available moisture capacity, alkali or soluble salts, or shallow rooting zone.
  - Dryland unit VIs-6.—Gravelly sandy soils that have open sand and gravel within 10 to 20 inches of the surface on undulating to rolling narrow ridges and knobs of terrace breaks and dissected alluvial terraces.
- Subclass VIw.—Soils severely limited by excess water and generally unsuitable for cultivation.
  - Dryland unit VIws-10.—Deep soils which have alkali or soluble salts in all or part of the profile.
  - Irrigated unit VIws-10.—Deep, nearly level to gently sloping soils which have alkali or soluble salts in all or part of the profile on

flood plains, terraces, and foot slopes and in upland swales.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife food and cover.
  - Subclass VIIe.—Soils subject to severe erosion unless properly managed.
    - Dryland unit VIIe-14.—Shallow, well drained, moderately coarse textured, moderately steep to steep soils on uplands and shallow, well drained, medium textured and fine textured, gently sloping to moderately steep soils on uplands.
    - Dryland unit VIIe-15.—Deep, excessively drained, coarse textured, steep soils on uplands.
    - Dryland unit VIIe-82.—Gullied land.
  - Subclass VIIs.—Soils which have severe limitations because of a shallow rooting zone.
    - Dryland unit VIIs-6.—Nearly level alluvial sands and gravel on flood plains.

Class VIII soils and landforms have limitations that preclude their use for commercial production of plants and that restrict their use to recreation, wildlife habitat, or water supply or to esthetic purposes.
  - Subclass VIIIe.—Soils and landforms which have limitations because of erosion.
    - Dryland unit VIIIe-15.—Deep, loose, barren sands on shifting dunes.
  - Subclass VIIIs.—Landforms that consist of exposed bedrock.
    - Dryland unit VIIIs-83.—Soft or hard, barren, steep to gently sloping outcrops of siltstone, sandstone, and igneous and metamorphic rock.

Dry cropland[3]

Most of the survey area was rolling grassland before settlement began in 1880. Small grain is the major dryland crop. Winter wheat is the most common crop. Some corn and sorghum are grown, but the lack of adequate moisture in summer limits production. The soils in the survey area are well suited to grasses, and alfalfa grows well on a few soils.

Soil blowing has been a problem in the survey area since the soils were first farmed. It reached a peak during the drought of the 1930's. Farmers then began using wind stripcropping and are still using it. Soil blowing on some soils can be effectively controlled by wind stripcropping. Other soils need additional protection; crop residue left on the surface and surface ridging are beneficial.

The hazard of erosion is moderate to severe on some of the soils. The practices used to control soil blowing control erosion only partially. Leaving additional amounts of crop residue on the surface is needed to adequately control erosion on these soils. Terracing and contour stripcropping may be needed in addition to stubble mulching on the steeper, longer slopes. Diversion ditches and grassed waterways are used to control runoff.

Maintaining fertility is generally not a problem if the wheat-fallow system of farming is used. A lack of moisture limits crop production on most dryland soils. No general fertilizer recommendations are given for dryland soils, but some fertilizer is beneficial on soils that have a water table within the reach of plant roots or that receive moisture from runoff. Grass responds to nitrogen fertilizer, but the soil should be tested before fertilizer is applied.

There is generally no advantage to including legumes or other green manure crops in a dryland cropping system. Yields are often lowered because the green manure crop depletes the moisture supply. Using grasses and legumes in rotation with wheat and fallow is also of little value. Establishing grass and legumes is difficult, and the stands are not dependable. Hay and pasture seedings are done on a permanent basis.

Moisture conservation is needed on dryland soils. Precipitation has to be used efficiently to obtain satisfactory yields. The most widely used cropping system for dryland grain is alternating crops with fallow. Leaving crop residue on the surface helps to increase water intake and to decrease erosion and soil blowing.

Compaction from tillage can be a problem on some soils. Varying the depth of tillage and avoiding tillage when soils are wet help prevent the formation of tillage pans or compacted layers.

Irrigated cropland

In most years, natural moisture is adequate for plant needs in spring and the soils are not irrigated until the end of June. The water supply of most irrigation systems is limited, and conservation of available water is needed. The major irrigated crops are sugar beets, beans, corn for grain or silage, potatoes, small grains, and alfalfa and grass for hay or pasture.

The three major concerns of management of irrigated soils in the survey area are controlling erosion, maintaining soil structure, and maintaining fertility.

The irrigated soils are subject to erosion and soil blowing unless proper management practices are used. Soil blowing is a hazard on sandy soils that are left bare by row crops that produce little or no residue. A protective cover of small grain can be established if seeding is done early and moisture and fertility needs are met. Rough tillage is often used successfully to control soil blowing on bare land. Maximum use of crop residue is needed to protect the soils in winter. Alternating row crops with crops that produce a large amount of residue also reduces the hazard of soil blowing.

On soils irrigated with a center pivot system, control of soil blowing is difficult. This kind of system can adequately irrigate very sandy soils. The entire irrigated circle commonly is used for a crop that produces very little residue. In such fields, the hazard of soil blowing is severe. Some erosion control practices that should be given special consideration are using minimum tillage, growing cover crops, using wind stripcropping, and growing grasses and legumes.

If irrigation water is properly applied, erosion from it will be controlled, but the hazard of erosion from natural rainfall exists on sloping areas that are irrigated. Furrow irrigation on slopes where the furrow gradient exceeds 2 percent is impractical, because runoff from irrigation water and natural rainfall will carry away soil material. The slope gradient can be reduced by bench leveling and by farming across the slope or by using a contour furrow system. A ditch and underground pipe system sometimes creates a serious erosion problem, but surface interception ditches can be installed to divert runoff. A similar problem occurs if center pivot systems are used in large fields.

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[3] R.L. TRESLER, conservation agronomist, Soil Conservation Service, helped prepare this section.

Maintaining soil structure is necessary to provide adequate soil aeration and desirable water intake rate, and to maintain good soil tilth. Soil should not be tilled when the moisture content is high. Using a grass-legume mixture in the rotation is the most common method of maintaining soil structure. Applying barnyard manure and plowing crop residue into the soil add needed organic material. Crop residue should not be burned, because burning increases the hazard of soil blowing and destroys organic matter; thus fertility is lowered.

Maintaining soil fertility is a continuing concern of management. Nitrogen is the plant nutrient most needed by crops. Phosphate generally is needed for sugar beets and alfalfa, and zinc is needed in some areas. Soil testing is available through the Experiment Station of the University of Wyoming.

Soils most suitable for irrigated crops have medium texture, good structure, and adequate depth for moisture storage. They have a good available water capacity and a moderate water intake rate. They are free of excessive salts and alkali.

Some of the limitations affecting the use of the soils of the survey area are discussed in the following paragraphs.

Alkalinity.—Alkalinity is caused by an excessive amount of exchangeable sodium in the soil. It causes deterioration of structure, a low water intake rate, poor tilth, and poor aeration. In areas where the substratum is well drained, gypsum can be applied and the soil can be reclaimed by leaching. Where subdrainage is poor, the best alternative is to grow tolerant crops.

Salinity.—Salinity is caused by an excessive amount of soluble salts and generally is associated with a high water table. The salts interfere with plant growth by making it more difficult for them to take in water. The soil can be reclaimed through draining and leaching if substrata conditions permit. If drainage is not possible, salt-tolerant crops can be grown.

Soil depth.—More than 40 inches of soil is desirable for irrigated crops. Soils less than 40 inches deep require more frequent irrigation, have less room for root development, and are less productive.

Soil drainage.—A high water table generally is associated with varying degrees of salinity and generally is detrimental to crops. This condition is caused by overirrigation and by water moving from ditches and higher lying soils and by ponded surface water. These soils can be reclaimed through drainage if subsurface conditions are favorable. If reclamation is not possible, tolerant crops must be grown.

Soil moisture.—Successful irrigated farming depends on proper use of water. The objective of irrigation is to keep enough moisture for normal plant growth in the soil at all times. The soil is a reservoir that can hold a certain amount of water. Plants use this water, and the reservoir needs to be replenished. Water that penetrates beyond the reach of plant roots is lost to the crop, and soluble plant nutrients are leached out. The Soil Conservation Service and cooperating agencies have prepared irrigation guides that are helpful in planning irrigation systems. This information is available at local offices of the Soil Conservation Service.

Soil slope.—The preferred soil for irrigation is nearly level. A slope of more than 2 percent, unless contoured, should be restricted to close-growing crops because of the erosion hazard. A grass-legume mixture on slopes of more than 2 percent should include a sod-forming grass. Where the slope is more than 9 percent, at least half of the mixture should be sod-forming grass. Where the slope is more than 15 percent, the soils are unsuitable for irrigation.

Soil texture.—A severe hazard of soil blowing exists on areas of sandy soils, and a cropping system that protects the soils must be used. Very sandy soils have a very rapid rate of water intake and low available water capacity. On these soils, frequent application of water is needed to maintain moisture for normal plant growth and to prevent the loss of water beyond the root zone. Clay soils need special treatment because of their poor tilth and very slow rate of water intake. Tillage must be done when the moisture content is neither too low nor too high. Incorporating organic matter into the soil is important to maintain tilth and structure.

Estimated yields

The estimated yields for the principal crops grown in the survey area are given in table 2. These yields are given for two levels of management. The estimates in the A columns can be expected under an average level of management and those in the B columns under a high level of management.

Wind stripcropping and alternating crops with summer fallow are practices that are considered part of an average level of management for dryland crops.

Practices considered part of a high level of management for dryland crops include the following: wind stripcropping; alternating crops with summer fallow; stubble mulching; terracing moderately fine textured and medium textured soils on long slopes; timely management of seeding, tillage, and harvesting operations; controlling weeds, disease, and insects; and using high quality seed. Using contour stripcropping, emergency tillage, and chiseling if needed are also considered high level management practices.

Practices considered part of an average level of management for irrigated crops include ordinary management of irrigation water, minimum use of fertilizer and manure, crop rotation for insect and disease control only, and emergency tillage of acreage in beans.

Practices considered part of a high level of management for irrigated crops include improved management of irrigation water; the use of a cropping system that protects the soil; the use of fertilizer, amendments and manure in proper amounts; the control of weeds, insects, and disease; the use of emergency tillage if needed; and timely completion of these management practices.

The estimated yields given in table 2 are based on normal growing conditions for the area. Damage from frost, hail, drought, insects, and floods was not consid-

TABLE 2.—*Estimated average yields per*

[Yields in the A columns can be expected under an average level of management; those in the B columns can be expected under acreage. Only arable

Mapping unit	Irrigated crops							
	Alfalfa		Barley		Beans		Sugar beets	
	A	B	A	B	A	B	A	B
	Tons	*Tons*	*Bu*	*Bu*	*Bu*	*Bu*	*Tons*	*Tons*
Albinas loam, 0 to 6 percent slopes	3.5	5.0	45	65	---	---	---	---
Alice fine sandy loam, 0 to 6 percent slopes	3.0	4.5	45	60	32	40	14	20
Alice fine sandy loam, 6 to 10 percent slopes	2.0	3.0	35	45	23	32	11	16
Bordeaux fine sandy loam, 0 to 3 percent slopes	---	---	---	---	---	---	---	---
Bordeaux fine sandy loam, 3 to 10 percent slopes	---	---	---	---	---	---	---	---
Dailey-Valent loamy fine sands, 0 to 3 percent slopes	2.0	4.0	30	40	23	33	11	17
Dailey-Valent loamy fine sands, 3 to 10 percent slopes	1.0	2.5	20	35	---	---	---	---
Featherlegs-Wolf loams, 0 to 6 percent slopes	---	---	---	---	---	---	---	---
Hargreave-Noden sandy loams, 0 to 6 percent slopes	3.5	4.5	45	60	---	---	---	---
Hargreave-Noden sandy loams, 6 to 10 percent slopes	2.5	3.5	35	55	---	---	---	---
Jayem fine sandy loam, 0 to 3 percent slopes	3.5	4.5	45	60	---	---	---	---
Jayem fine sandy loam, 3 to 10 percent slopes	2.5	3.5	35	55	---	---	---	---
Keota loam, 0 to 6 percent slopes	---	---	---	---	---	---	---	---
Otero fine sandy loam, 0 to 6 percent slopes	---	---	---	---	---	---	---	---
Rosebud-Hargreave fine sandy loams, 0 to 6 percent slopes	3.5	4.5	45	60	---	---	---	---
Rosebud-Trelona fine sandy loams, 0 to 6 percent slopes	3.0	4.0	40	55	---	---	---	---
Rosebud-Trelona fine sandy loams, 6 to 10 percent slopes	2.5	3.5	35	50	---	---	---	---
Satanta-Noden complex, 0 to 6 percent slopes	---	---	---	---	---	---	---	---
Satanta-Noden complex, 6 to 10 percent slopes	---	---	---	---	---	---	---	---
Torrifluvents-Fluvaquents complex	1.5	2.5	30	45	---	---	---	---
Valent-Dwyer loamy fine sands, 0 to 3 percent slopes	2.0	4.0	30	40	23	33	11	17
Valent-Dwyer loamy fine sands, 3 to 10 percent slopes	1.0	2.5	20	35	---	---	---	---
Vetal fine sandy loam, 0 to 6 percent slopes	2.5	4.5	45	65	30	40	16	20
Vetal fine sandy loam, 6 to 10 percent slopes	2.0	4.0	40	60	25	35	14	18

ered. The estimates reflect the inherent differences in soils and in their response to management. They are based on data obtained from farmers, the Wyoming Agricultural Experiment Station, the County Agricultural Agent, officials of irrigation districts, and the Soil Conservation Service.

Range[4]

Approximately 94 percent of the survey area is in native range. Most ranches in northern Goshen County are cow-calf operations. The calves and some yearling steers and heifers are sold in the fall. There are only a few sheep ranches.

The best management of range depends on how heavily it is grazed and the season of use.

Range is used efficiently when approximately half the foliage is left at the end of the growing season. Thus, only half of the key forage plants should be grazed during a growing season. This allows the plants to store enough food to maintain vigor and successfully compete with other plants. It also provides a mulch that helps control erosion, helps plants to take in water, and helps the soils to store moisture. This residue also provides a food reserve during short-term droughts. Erosion control is especially important on the Sands, Choppy sands, and Sandy range sites, where the hazard of soil blowing is severe if the plant cover becomes too sparse.

Controlling grazing is difficult in large pastures where there are inclusions of several different range sites and a minimum of watering places. Range sites, such as Sands and Choppy sands, that have vegetation of tall grass are often overgrazed when they are included in a pasture with other range sites.

More even grazing of rangeland can be promoted by supplying a sufficient number of well located water places. Also, salt and supplies of mineral supplements can be placed in lightly grazed areas that are away from watering places.

Range sites and condition classes

Soils in areas where conditions are sufficiently uniform to produce the same kinds and amounts of plants are grouped into range sites.

A plant community that has not undergone major change is the potential, or climax, plant community for that site. The plant community reproduces itself

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[4] CHARLES MCAFEE and DWIGHT KIMSEY, range conservationists, Soil Conservation Service, assisted in the preparation of this section.

acre under two levels of management

a high level of management. Dashes indicate that the soil is not suited to the crop or that the crop is grown on a very small soils are listed]

Irrigated crops—Continued								Dryland crops					
Corn for grain		Corn for silage		Oats		Potatoes		Barley		Oats		Wheat	
A	B	A	B	A	B	A	B	A	B	A	B	A	B
Bu	*Bu*	*Tons*	*Tons*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*	*Bu*
85	115	16	22	---	---	350	500	26	31	28	34	25	30
70	100	14	20	55	80	300	450	17	21	19	24	17	21
55	80	11	15	45	60	200	300	15	19	17	21	15	19
---	---	---	---	---	---	---	---	19	24	21	26	19	24
---	---	---	---	---	---	---	---	16	20	18	23	16	20
45	70	10	15	40	55	250	400	10	15	11	14	10	13
---	---	---	---	35	50	---	---	---	---	---	---	---	---
---	---	---	---	---	---	---	---	26	30	28	32	25	28
---	---	---	---	50	75	---	---	23	28	24	29	22	26
---	---	---	---	40	60	---	---	---	---	---	---	---	---
---	---	---	---	50	75	---	---	22	26	23	28	22	24
---	---	---	---	40	60	---	---	16	20	18	22	16	20
---	---	---	---	---	---	---	---	16	19	17	20	15	18
---	---	---	---	---	---	---	---	15	19	17	21	15	19
---	---	---	---	50	75	---	---	17	21	19	24	17	21
---	---	---	---	45	70	---	---	11	14	12	15	11	14
---	---	---	---	40	65	---	---	9	11	10	12	9	11
---	---	---	---	---	---	---	---	26	31	28	34	25	30
---	---	---	---	---	---	---	---	21	25	22	26	20	24
---	---	---	---	---	---	---	---	---	---	40	55	---	---
45	70	10	15	40	55	250	400	---	---	---	---	---	---
---	---	---	---	35	50	---	---	---	---	---	---	---	---
60	100	15	21	50	75	300	500	18	23	20	25	18	23
55	95	13	19	45	70	250	450	16	21	18	23	16	21

and does not change so long as the environment remains the same.

Disturbances such as overgrazing and excessive burning, plowing, or erosion can change the climax plant community or even destroy it if the disturbance is severe. If the range site does not deteriorate significantly because of such disturbances, the secondary plantlife will progress towards the natural potential, or climax, plant community for the site.

Four range site condition classes indicate the degree of departure from the potential, or climax, vegetation caused by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand. It is in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is less than 25.

When changes occur in the climax plant community because of grazing or a disturbance in the environment, some plant species increase and others decrease depending on the grazing animal, the season of use, and the degree of use. By comparing the composition of the present plant community to the potential plant community, it is possible to know which species have increased and which have decreased. Plants that are not part of the climax community but that are in the present plant community are invaders of the site.

The composition of climax and present plant communities, together with other range site information, provides the basis for selecting range management systems.

Management programs for rangeland generally try to increase desirable plants and restore rangeland to conditions as near climax as possible. Some programs are designed to create or maintain plant communities somewhat different from the climax to fit specific needs in the grazing program, to provide for wildlife habitat, or to provide other benefits. Any management objective should be compatible with conservation objectives.

The twelve range sites in the survey area are briefly described in the following pages, and the climax plants and principal invaders on the sites are named. An estimate of the potential annual yield on range that is in excellent condition, unless otherwise stated, is given for favorable and unfavorable seasons. These yields are given as the normal high and low rather than the extremes. Yields are the total annual yield in pounds of air-dry herbage per acre including the current year's growth of leaves, stems, twigs, and fruit of all plants on the site. Not all of this herbage is usable by livestock. To learn what soils make up each site, refer to the "Guide to mapping units" at the back of this soil survey.

Subirrigated range site

The soils in this range site have variable texture and consist of stratified alluvium along streams. These soils mostly are somewhat poorly drained and have a fresh water table during most of the growing season.

Basin wildrye, big bluestem, switchgrass, little bluestem, and indiangrass make up 50 to 60 percent of the potential vegetation. Willows, Kentucky bluegrass, mat muhly, and sedges make up 40 to 50 percent.

If this site is in excellent condition, the total annual production is about 3,500 pounds of air-dry herbage per acre in unfavorable years and 5,000 pounds in favorable years. If the water table is relatively constant, the variation from year to year is smaller.

Range seeding can readily restore deteriorated range to its potential vegetation. This site responds well to a planned grazing system and to proper grazing use.

Saline subirrigated range site

The soils in this range site have variable texture and consist of stratified alluvium along streams. The soils mostly are somewhat poorly drained. The water table within the rooting depth of herbaceous plants is moderately saline or alkaline or both in spring and early in summer.

Alkali sacaton, western wheatgrass, switchgrass, and alkali cordgrass make up 50 to 60 percent of the potential vegetation; inland saltgrass, sedges, and greasewood make up 40 to 50 percent. As the range condition deteriorates, inland saltgrass tends to increase.

If this site is in excellent condition, the estimated total annual production is about 3,000 pounds of air-dry herbage per acre in unfavorable years and 4,000 pounds in favorable years.

This site is not well suited to range seeding because of the saline-alkaline water table. It does respond well, however, to a planned grazing system and proper grazing use.

Sandy lowland range site

The soils in this range site are deep, well drained to excessively drained fine sandy loams and loamy fine sands on flood plains of perennial streams. The deep water table within the rooting depth of woody plants is nonsaline and nonalkaline. It is not within the depth of herbaceous plants.

Prairie sandreed, Indian ricegrass, sand bluestem, and needleandthread make up about 50 to 60 percent of the potential vegetation; western wheatgrass, blue grama, threadleaf sedge, sagewort, and cottonwood make up 40 to 50 percent. As the range condition deteriorates, woody species increase.

If this site is in excellent condition, the estimated total annual production is about 1,600 pounds of air-dry herbage per acre in unfavorable years and about 3,000 pounds per acre in favorable years.

This site responds well to range seeding in areas that have deteriorated to poor condition. It also responds well to a planned grazing system and proper grazing use. Brush management should be used in areas where it is needed.

Sands range site

The soils in this range site consist of deep, excessively drained sands on uplands in the northern and eastern parts of the survey area. These soils are gently sloping to moderately steep.

Prairie sandreed, sand bluestem, and Indian ricegrass make up about 60 to 70 percent of the potential vegetation; needleandthread, sand dropseed, sand sagebrush, blue grama, forbs, and yucca make up 30 to 40 percent. As the range condition deteriorates, sand sagebrush, green sagewort, and blue grama increase.

If this site is in excellent condition, the estimated total annual production is about 900 pounds of air-dry herbage per acre in unfavorable years and about 1,800 pounds per acre in favorable years.

Proper grazing is needed on this site to maintain adequate residue for protection against soil blowing. Range seeding is used where needed. Response to planned grazing systems is good.

Sandy range site

The soils in this range site consist of deep, well drained and excessively drained fine sandy loams and loamy fine sands on uplands and alluvial fans. These soils are nearly level to moderately steep.

Needleandthread, Indian ricegrass, sand bluestem, and prairie sandreed make up about 50 to 60 percent of the potential vegetation; blue grama, threadleaf sedge, western wheatgrass, sagewort, Sandberg bluegrass, and sand dropseed make up 40 to 50 percent. As the range condition deteriorates, blue grama and threadleaf sedge increase.

If this site is in excellent condition, the estimated total annual production is about 600 pounds of air-dry herbage per acre in unfavorable years and about 1,800 pounds per acre in favorable years.

The hazard of soil blowing is high if adequate residues are not maintained on this site. This site responds well to planned grazing systems and to range seeding where needed.

Loamy range site

The soils in this range site consist of deep and moderately deep, well drained very fine sandy loams, loams, silt loams, and fine sandy loams that have a subsoil of loam or clay loam. These soils are on nearly level to moderately steep uplands and alluvial fans throughout most of the survey area.

Western wheatgrass, green needlegrass, and needleandthread make up 50 to 60 percent of the potential vegetation; blue grama, threadleaf sedge, buffalo grass, Sandberg bluegrass, sagewort, and forbs make up 40 to 50 percent. As the range condition deteriorates, blue grama, threadleaf sedge, and buffalograss increase.

If this site is in excellent condition, the estimated total annual production is about 600 pounds of air-dry herbage per acre in unfavorable years and about 1,800 pounds per acre in favorable years.

This site is well adapted to range seeding where needed. It responds well to planned grazing systems and to brush management where sagewort and snakeweed have increased.

Choppy sands range site

The soils in this range site consist of deep, loose, excessively drained fine sands that are in the southeastern and central part of the survey area. These soils are characterized by stabilized dunes and blowouts. Slopes are irregular and steep.

Prairie sandreed, sand bluestem, Indian ricegrass, and little bluestem make up about 60 to 90 percent of the potential vegetation; needleandthread, sand dropseed, and sand sagebrush make up 10 to 30 percent. As range condition deteriorates, sand sagebrush and sand dropseed increase.

If this site is in excellent condition, the estimated total annual production is about 700 pounds of air-dry herbage per acre in unfavorable years and about 1,800 pounds per acre in favorable years.

Proper grazing is needed on this site to maintain adequate plant residue for protection against soil blowing. The site responds well to range seeding where needed, and to planned grazing systems.

Coarse upland range site

This range site consists of deep, well drained, gravelly loamy soils on uplands.

Western wheatgrass, little bluestem, needleandthread, and sideoats grama make up 60 to 70 percent of the potential vegetation; threadleaf sedge, blue grama, fringed sagewort, and forbs make up 30 to 40 percent. As range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase.

If this site is in excellent condition, the estimated total annual production is about 500 pounds of air-dry herbage per acre in unfavorable years and 1,400 pounds in favorable years.

Because of soil conditions, this site is not well suited to range seeding. It responds well to planned grazing systems.

Shallow sandy range site

The well drained upland soils of this range site are fine sandy loams underlain by soft sandstone. These soils are in the southern and eastern parts of the survey area. They are gently sloping to steep.

Little bluestem, sideoats grama, bluebunch wheatgrass, needleandthread, Indian ricegrass, and mountainmahogany make up about 60 to 70 percent of the potential vegetation; threadleaf sedge, blue grama, red threeawn, sand dropseed, yucca, and forbs make up 30 to 40 percent. As range condition deteriorates, blue grama, threadleaf sedge, and fringed sagewort increase.

If this site is in excellent condition, the estimated total annual production is about 600 pounds of air-dry herbage per acre in unfavorable years and about 1,300 pounds per acre in favorable years.

Enough plant residue must be maintained to protect these soils from soil blowing. Brush management is used on range in fair condition. This site responds well to planned grazing systems.

Shallow igneous range site

This range site consists of shallow loamy soils in pockets among outcrops of granite in the western part of the area.

Western wheatgrass, bluebunch wheatgrass, needleandthread grass, mountainmahogany, and antelope bitterbrush make up about 60 to 70 percent of the potential vegetation; slimstem muhly, Idaho fescue, black sagebrush, threetip sagebrush, and forbs make up 30 to 40 percent.

If this site is in excellent condition, the estimated total annual production is about 600 pounds of air-dry herbage per acre in unfavorable years and about 1,200 pounds per acre in favorable years.

Because the soils are shallow, this site is poorly adapted to range seeding. It responds well to planned grazing systems and to brush management on areas in fair range condition.

Shallow loamy range site

This range site is on uplands in the northwestern part of the survey area. The well drained, loamy soils of this range site are underlain by soft sandstone and siltstone. They are nearly level to moderately steep.

Sideoats grama, bluebunch wheatgrass, western wheatgrass, needleandthread, and Indian ricegrass make up 50 to 60 percent of the potential vegetation; blue grama, threadleaf sedge, red threeawn, and fringed sagewort make up 40 to 50 percent. As range condition deteriorates, blue grama and threadleaf sedge increase.

If this site is in excellent condition, the estimated total annual production is about 500 pounds of air-dry herbage per acre in unfavorable years and about 1,200 pounds per acre in favorable years.

This site responds moderately well to planned grazing systems and proper grazing use. This site is not well suited to range seeding because the soils are shallow.

Gravelly range site

The soils in this range site consist of well drained to excessively drained gravelly sands on terrace rims in the southern part of the survey area. These soils are gently sloping to steep.

Little bluestem, bluebunch wheatgrass, needleandthread, and prairie clover make up 70 to 80 percent of the potential population; blue grama, threadleaf sedge, red threeawn, sand dropseed, sagewort, Sandberg bluegrass, and forbs make up 20 to 30 percent.

If this site is in excellent condition, the estimated total annual production is about 300 pounds of air-dry herbage per acre in unfavorable years and about 900 pounds per acre in favorable years.

This site is not suited to range seeding because of droughty soil conditions. It responds moderately well to planned grazing systems.

Windbreaks[5]

Most of the northern part of Goshen County is treeless. Trees grow naturally only on the flood plains along the major drainageways and in the mountains of the Hartville uplift. Cottonwoods and willows grow on the Torrifluvents-Fluvaquents complex, Torrifluvents-Fluvaquents complex, saline, and Ustic Torrifluvents, undulating. These trees have no commercial value other than as fuel wood. They are used mainly to protect streambanks and to protect livestock during blizzards. They also provide cover for wildlife.

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[5] GEORGE K. DERN, biologist, Soil Conservation Service, assisted in preparation of this section.

Ponderosa pine and Rocky Mountain juniper grow in areas of Rock outcrop-Tassel complex, Motoqua-Rock outcrop complex, and Wendover-Rock outcrop complex. They have little or no commercial value. Fenceposts can be cut from juniper stands if the trees are large enough. Also in this area are skunkbush sumac, mountainmahogany, currant, and other shrubs.

Farmers and ranchers have planted trees in the survey area mostly for windbreaks that are needed to protect farmsteads and feedlots. Windbreaks provide protection against the cold northerly or westerly wind in winter. They trap blowing snow, control snowdrift, provide food and cover for wildlife, and provide shade in summer.

A windbreak provides protection for a distance of about 20 times the height of the trees. Low-growing shrubs should be planted in rows on the windward side, medium or tall shrubs in the next rows, and tall trees in the center or in the leeward rows. For maximum winter protection, windbreaks should have two or more rows of evergreens such as Rocky Mountain juniper or ponderosa pine. If the moisture supply is adequate, as in irrigated areas, Colorado blue spruce can be used. Evergreens live longer and provide more protection than broadleaf trees, but they are harder to establish and they grow more slowly.

Tree planting

Preparations for planting trees in the survey area vary with the kind of soil. For example, Keota and Mitchell soils, which are in the Silty to clayey windbreak site, should be summer fallowed for a year before planting. Jayem and Manter soils, which are sandy and are readily blown if left uncovered, require only a narrow strip of fallow for each tree row. Natural cover or planted cover between the tree rows protects the seedlings from strong wind. When tree growth has reduced the hazard of soil blowing, windbreaks should be clean tilled to reduce grass competition for moisture.

Some soils receiving extra runoff water or water from a water table can be used for water-tolerant species of trees and shrubs. Drought-tolerant species such as Siberian peashrub, Russian-olive, Siberian elm, and Rocky Mountain juniper can be used on droughty soils. Other soils cannot be used for trees because of texture, alkalinity, salinity, slope, or wetness.

Windbreak sites

The soils in the survey area have been grouped into five windbreak sites. The soils on each site support similar trees, need similar management, and produce about the same yield of trees and shrubs. Rock outcrop, Sandstone outcrop, and Dune land are not included in the groupings. To find the site of any given soil refer to the "Guide to mapping units."

Silty to clayey windbreak site

This site consists of deep and moderately deep, well drained loams, silt loams, and clay loams.

Caragana, lilac, plum, and sumac are suitable shrubs on this site. Austrian pine, eastern redcedar, ponderosa pine, and Rocky Mountain juniper are suitable conifers. Russian-olive is a suitable short broadleaf tree, and green ash, hackberry, and Siberian elm are suitable medium and tall broadleaf trees.

A nonirrigated site should be left fallow for one summer before planting. Diversion ditches can be used to collect water and carry it onto the site, and snow fences can be used to drift snow onto the plantings. If the surface layer is dry at planting time, the seedlings should be watered after planting. Tree rows should be clean cultivated.

If the site is to be irrigated, the irrigation system should be prepared before planting. A clean seedbed should be prepared and irrigated as needed. Clean cultivation is needed only until trees are about 3 years old.

Sandy windbreak site

This site consists of deep and moderately deep, well drained very fine sandy loams, fine sandy loams, and sandy loams and the loamy fine sands that are suitable for dryfarmed crops.

Caragana, chokecherry, lilac, sand cherry, and sumac are suitable shrubs on this site. Austrian pine, eastern redcedar, ponderosa pine, and Rocky Mountain juniper are suitable conifers. Russian-olive is a suitable short broadleaf tree, and green ash, hackberry, and Siberian elm are suitable medium and tall broadleaf trees.

On nonirrigated sites, only the strips where tree rows are to be planted should be left in summer fallow. Natural ground cover should be maintained or cover crops planted between the tree rows to prevent the soil from drifting and from blasting trees during high winds. Planting on the contour is best if the slope has a favorable aspect and is more than 3 percent. Snow fences are used to drift snow onto the plantings.

If the site is to be irrigated, the irrigation system should be prepared before planting. This site needs to be irrigated more frequently than the Silty to clayey site but in smaller amounts.

Very sandy windbreak site

This windbreak site consists of deep, excessively drained sands and loamy fine sands that generally are not suitable for dryfarmed crops.

Sumac is a suitable shrub on this site. Austrian pine, ponderosa pine, and Rocky Mountain juniper are suitable conifers. Broadleaf trees are not suitable.

This site is seldom irrigated. Narrow strips should be prepared where each tree row is to be planted. Natural ground cover should be maintained between the tree rows. Only drought-tolerant trees and shrubs should be planted. Planting on the contour where possible is best. The tree rows should be cultivated to control weeds and conserve moisture. Snow fences help to drift snow onto tree plantings and protect seedlings. Wood shingles should be placed around evergreens for the first 2 or 3 years.

Moderately wet windbreak site

Torrifluvents-Fluvaquents complex is the only mapping unit in this site. The site is subject to occasional flooding. Fluvaquents have a fluctuating water table.

Caragana, chokecherry, honeysuckle, lilac, plum, cherry, and sumac are suitable shrubs for this site. Austrian pine, blue spruce, eastern redcedar, ponderosa pine, and Rocky Mountain juniper are suitable conifers. Russian-olive is a suitable short broadleaf tree, and cottonwood, golden willow, green ash, hackberry, Siberian elm, and white willow are suitable medium and tall broadleaf trees.

A clean seedbed should be prepared, and the sod removed by plowing, disking, and harrowing. If water is near the surface, willow, cottonwood, or other water-tolerant trees should be planted. Clean cultivation is needed until the trees are taller than the weeds.

Unsuitable windbreak site

This site consists of shallow soils, saline and alkali soils, loose sands on choppy slopes, and very poorly drained soils. These soils are very poorly suited to trees, and most tree plantings are unsuccessful.

Wildlife[6]

Wildlife in an area is affected by the kind and amount of vegetation and by land use, both of which are influenced by the fertility of the soil, irrigation, and topography. In rough areas that are generally grazed, for example, the amount of vegetation left in the fall is important in determining wildlife populations.

In table 3, the potential of each soil association for producing elements of wildlife habitat is rated *good, fair*, or *poor*. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations will affect management, and satisfactory results can be expected if the soil association is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intense management and fairly frequent attention are needed to produce satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

The location of the soil associations in the survey area is shown on the general soil map at the back of this survey.

Table 3 shows the potential of the soils, by soil association, to produce food and cover for specific kinds of wildlife. The potential is based on the characteristics of the major soils in the association. The capacity of a soil to hold water is an important factor in determining wildlife habitat. It is also important for planning water development for fish, waterfowl, and furbearers. Marshes, springs, and other natural water areas should be protected and maintained or improved as aquatic and marsh habitat. The topography of the area determines where marshes and fish ponds can be developed. Deep draws with deep side slopes are needed for fish ponds. Shallow basins that have gradually sloping sides are needed for waterfowl.

The vegetation of the survey area provides food and cover for a variety of wildlife, including pheasant, deer, antelope, and cottontails. Beaver are found along the smaller creeks. Raccoons frequent all water areas. Red fox, weasels, and skunks are found throughout the area. Small birds common to rangeland are also found throughout the area.

The inadequate water supply in much of the area limits the wildlife population. Water developments benefit many species. The largest population of pheasants, for example, is found in the irrigated areas. Vegetation in areas such as draws, ditchbanks, and fence rows provides winter cover and nesting sites. A large part of the area is range and is potential habitat for sharp-tailed grouse.

Farmstead and field windbreaks and other woody plantings benefit most kinds of wildlife. Planning and protecting vegetation for wildlife food and cover contribute significantly to the wildlife in the area. Important windbreak plants for wildlife are listed in the section "Windbreaks." All of the windbreak plants listed will provide food or cover for wildlife.

Native trees and shrubs provide year-round food and cover for all kinds of wildlife. During winter storms they often provide the only available food and cover. Plant communities in good to excellent condition that include shrubs and trees such as winterfat, mountainmahogany, big sagebrush, rabbitbrush, cottonwood, willow, and juniper, should be maintained for wildlife use.

Most domestic and native herbaceous plants provide food or cover for wildlife. Domestic grains and grasses are important to pheasants and rabbits. Corn, beans, and wheat provide abundant food in fall. Annual weeds and other plants provide food in fall and winter. Dense patches of unharvested herbaceous plants are needed for winter cover. Alfalfa provides excellent nesting sites for pheasants. The best habitat has a variety of plants that provide food and especially cover on a year-round basis.

Native herbaceous plants, including western wheatgrass, green needlegrass, little bluestem, vetches, and scarlet globemallow, provide nutritious green forage for lactating mule deer and antelope.

Engineering[7]

This section is useful to planning commissions, town and city managers, land developers, engineers, contractors, farmers, and others who need information about soils used as structural material or as foundation on which structures are built.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, drainage, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These

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[6] GEORGE K. DERN, biologist, Soil Conservation Service, assisted in the preparation of this section.

[7] LAWRENCE W. JENSEN, agricultural engineer, Soil Conservation Service, assisted in preparation of this section.

TABLE 3.—*Potential of soils, by soil association, for wildlife habitat*

[Dashes indicate that the habitat element is not required by the species]

Soil association	Wildlife	Potential for—		
		Woody cover	Herbaceous cover	Food
1. Jayem-Manter-Alice association.	Pheasant	Poor	Good	Good.
	Sharp-tailed grouse	—	Good	Good.
	Deer	Fair	Fair	Fair.
	Antelope	—	Good	Good.
	Rabbit	Poor	Fair	Good.
2. Satanta-Noden-Rosebud association.	Pheasant	Poor	Poor	Fair.
	Sharp-tailed grouse	—	Good	Good.
	Deer	Fair	Fair	Fair.
	Antelope	—	Good	Good.
	Rabbit	Poor	Good	Good.
3. Jayem-Manter-Trelona association.	Pheasant	Poor	Poor	Poor.
	Sharp-tailed grouse	—	Good	Good.
	Deer	Fair	Fair	Fair.
	Antelope	—	Good	Good.
	Rabbit	Poor	Good	Good.
4. Satanta-Rosebud-Lambman association.	Pheasant	Poor	Poor	Poor.
	Sharp-tailed grouse	—	Fair	Fair.
	Deer	Good	Good	Good.
	Antelope	—	Good	Good.
	Rabbit	—	Good	Good.
5. Valent-Dwyer association.	Pheasant	Poor	Fair	Fair.
	Sharp-tailed grouse	—	Good	Good.
	Deer	Poor	Fair	Fair.
	Antelope	—	Good	Good.
	Rabbit	Poor	Good	Good.
6. Mitchell-Bordeaux-Epping association.	Pheasant	Poor	Fair	Fair.
	Sharp-tailed grouse	—	Good	Good.
	Deer	Poor	Poor	Poor.
	Antelope	—	Fair	Fair.
	Rabbit	Poor	Good	Good.
7. Featherlegs-Wolf association.	Pheasant	Poor	Fair	Fair.
	Sharp-tailed grouse	—	Fair	Fair.
	Deer	Poor	Good	Good.
	Antelope	—	Poor	Poor.
	Rabbit	Poor	Good	Good.
8. Wendover-Motoqua-Rock outcrop association.	Pheasant	Poor	Poor	Poor.
	Sharp-tailed grouse	—	Poor	Poor.
	Deer	Fair	Good	Good.
	Antelope	—	Poor	Poor.
	Rabbit	Good	Good	Good.
9. Torrifluvents-Fluvaquents-Torriorthents association.	Pheasant	Good	Good	Good.
	Sharp-tailed grouse	—	Poor	Poor.
	Deer	Good	Good	Good.
	Antelope	—	Poor	Poor.
	Rabbit	Good	Good	Good.
10. Dix-Alice association.	Pheasant	Poor	Poor	Poor.
	Sharp-tailed grouse	—	Poor	Poor.
	Deer	Poor	Fair	Fair.
	Antelope	—	Poor	Poor.
	Rabbit	Poor	Fair	Fair.

properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of rock, gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the soils on which they are built, to help predict performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.
8. Supplement information obtained from other published maps, reports, or aerial photographs in preparing maps and reports for use by engineers.

Most of the information in this section is presented in tables. Table 4 shows estimated soil properties significant to engineering. Table 5 gives interpretations for various engineering uses.

This information, along with the soil map and data in other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 5, and it also can be used to make useful maps.

This information, however, does not eliminate the need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths of more than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil can include small areas of other kinds of soil that have strongly contrasting properties and different suitability or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning in soil science. The Glossary defines many of these terms.

Engineering classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system (*2*) used by Soil Conservation Service engineers, the Department of Defense, and others, and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

In the Unified system, soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes, for example, CL–ML.

The AASHTO system is used to classify soils according to properties that affect their use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. The AASHTO classification for tested soils is given in table 4 for all soils mapped in the survey area.

Soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 4. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. In the following paragraphs, some of the column headings in table 4 are explained.

Soil texture is described in table 4 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used are defined in the Glossary of this soil survey.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 4 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to

TABLE 4.—*Estimated soil properties*

[In the first column, an asterisk before the series name indicates that at least one mapping unit in that series is made up of two necessary to refer to the other series as

Soil series and map symbols	Depth from surface	Dominant USDA texture	Classification	
			Unified	AASHTO
	In			
Albinas: 1B	0–15	Loam	ML	A–4
	15–38	Clay loam	CL	A–6
	38–60	Loam	SM or ML	A–4
Alice: 2B, 2C	0–60	Fine sandy loam	ML or SM	A–4
Ascalon Mapped only with Jayem and Manter soils.	0–6	Fine sandy loam	SM or SC	A–4
	6–20	Sandy clay loam	SC or CL	A–6
	20–60	Sandy loam	SC	A–4, A–2
Bordeaux: 3A, 3C	0–20	Fine sandy loam	SM	A–4
	20–60	Loam	ML	A–4
* Brownrigg: 4E For Featherlegs part, see Featherlegs series; for Wolf part, see Wolf series.	0–3	Very cobbly loam	GM–GC or GC	A–4
	3–8	Very gravelly clay loam	GC	A–6
	8–15	Very gravelly loam	GM–GC or GC	A–2
	15	Bedrock.		
* Dailey: 5A, 5C For Valent part, see Valent series.	0–60	Loamy fine sand	SM	A–2
* Dix: 6C, 6E For Alice part, see Alice series.	0–14	Very gravelly sandy loam	SM	A–2 or A–1
	14–60	Sand and gravel	SP or GP	A–1
Dune land: 7. Properties are too variable to be estimated.				
* Dwyer:				
Dwyer part of 32D and 32E	0–60	Fine sand	SP–SM or SM	A–3 or A–2
Dwyer part of 8D, 33A, and 33C For Valent part of 8D see Valent series; for Tassel part of 8D, see Tassel series.	0–60	Loamy fine sand	SM	A–2
Embry: 9A, 9C	0–60	Fine sandy loam	SM	A–2, A–4
Epping: 10C	0–13	Loam	ML or CL	A–4
	13	Bedrock.		
* Featherlegs: 11B, 11C, 12C For Wolf part, see Wolf series; for Brownrigg part of 12C, see Brownrigg series.	0–5	Loam	ML	A–4
	5–23	Clay loam	CL	A–6
	23–38	Loam	ML	A–4
	38–60	Very gravelly sandy loam	GW	A–1
* Hargreave: 13B, 13C For Noden part, see Noden series.	0–4	Sandy loam	SM	A–4
	4–19	Sandy clay loam	CL	A–6
	19–32	Fine sandy loam	SM	A–4
* Jayem: 14A, 14C, 15C, 16D For Ascalon part of 15C, see Ascalon series; for Manter part of 15C and 16D, see Manter series; for Trelona part of 16D, see Trelona series.	0–60	Fine sandy loam	SM	A–4
* Keota: 17B, 18C For Epping part of 18C, see Epping series.	0–36	Loam	ML	A–4
	36	Bedrock.		
Lambman Mapped only with Satanta and Willowman soils.	0–3	Loam	ML	A–4
	3–14	Clay loam	CL	A–6
	14–18	Loam	ML	A–4
	18	Bedrock.		
Manter Mapped only with Ascalon, Jayem, and Trelona soils.	0–60	Fine sandy loam, sandy loam.	SM or ML	A–2 or A–4

significant in engineering

or more kinds of soil. The soils in such mapping units can have different properties and limitations, and for this reason it is indicated. The symbol > means more than]

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				In per hr	*In per in of soil*	*pH*		
100	95–100	80–100	50–75	0.6–2.0	0.14–0.15	7.4–7.8	Low	Low.
---	100	80–100	50–80	0.6–2.0	0.18–0.20	7.4–8.4	Low	Moderate.
---	100	60–95	40–75	0.6–2.0	0.16–0.18	7.9–8.4	Low	Low.
---	100	95–100	40–55	2.0–6.0	0.14–0.15	7.4–8.4	Low	Low.
95–100	90–100	70–95	40–55	0.6–2.0	0.13–0.15	7.4–7.8	Low	Low.
95–100	90–100	80–100	40–55	0.6–2.0	0.13–0.15	7.4–8.4	Low	Moderate.
95–100	95–100	75–95	30–40	0.6–2.0	0.11–0.14	7.9–8.4	Low	Low.
---	100	70–80	40–50	2.0–6.0	0.13–0.15	7.4–8.4	Low	Low.
---	100	85–95	65–75	0.6–2.0	0.16–0.18	7.4–8.4	Moderate	Low.
85–90	70–80	60–75	40–50	0.6–2.0	0.10–0.12	7.4–7.8	Low	Low.
50–60	40–50	35–45	30–40	0.2–0.6	0.10–0.12	7.4–7.8	Low	Moderate.
50–60	40–50	35–45	25–35	2.0–6.0	0.06–0.08	7.9–8.4	Low	Low.
---	100	80–95	20–35	6.0–20	0.07–0.10	6.6–7.8	Low	Low.
45–55	40–50	25–35	15–20	0.6–2.0	0.07–0.09	7.4–8.4	Low	Low.
50–75	35–50	10–30	0–5	>20	0.03–0.05	7.9–8.4	Low	Low.
85–100	75–100	50–80	5–35	>20	0.04–0.11	7.4–8.4	Low	Low.
---	100	65–80	20–35	>20	0.08–0.11	7.4–8.4	Low	Low.
---	100	60–70	30–40	6.0–20	0.12–0.14	6.6–8.4	Low	Low.
80–100	80–100	75–95	65–75	0.6–2.0	0.16–0.18	7.9–9.0	Moderate	Moderate.
---	100	85–95	60–75	0.6–2.0	0.16–0.18	7.4–7.8	Low	Low.
---	100	80–100	70–80	0.2–0.6	0.19–0.21	7.4–8.4	Low	Moderate.
---	100	85–95	60–75	0.6–2.0	0.16–0.18	7.9–8.4	Low	Low.
30–45	25–40	15–25	0–5	>20	0.03–0.05	7.9–8.4	Low	Low.
---	100	55–75	40–50	2.0–6.0	0.13–0.15	6.6–7.3	Low	Low.
---	100	65–85	50–60	0.6–2.0	0.14–0.16	6.6–7.8	Low	Moderate.
---	100	55–75	40–50	2.0–6.0	0.13–0.15	7.4–7.8	Low	Low.
85–100	75–100	55–80	35–50	6.0–20	0.13–0.15	6.6–7.8	Low	Low.
95–100	95–100	85–95	60–75	0.6–2.0	0.16–0.17	7.9–8.4	Moderate	Low.
---	100	85–95	60–75	0.6–2.0	0.16–0.18	6.6–7.3	Low	Low.
---	100	80–100	50–80	0.2–0.6	0.19–0.21	7.4–7.8	Low	Moderate.
---	100	85–95	60–75	0.6–2.0	0.16–0.18	7.4–7.8	Low	Low.
95–100	75–100	45–85	25–55	6.0–20	0.12–0.14	6.6–8.4	Low	Low.

TABLE 4.—*Estimated soil properties*

Soil series and map symbols	Depth from surface	Dominant USDA texture	Classification	
			Unified	AASHTO
	In			
Mitchell: 19B, 19C, 19D	0–60	Loam	ML	A–4
* Motoqua: 20F	0–14	Very gravelly clay loam	GC or SC	A–2
Rock outcrop part is too variable to be estimated.	14	Bedrock.		
Noden	0–9	Sandy loam	SM–SC	A–2
Mapped only with Hargreave and Satanta soils.	9–16	Sandy clay loam	SC	A–6 or A–4
	16–60	Fine sandy loam	SM–SC	A–4
Otero: 21B, 21C	0–60	Fine sandy loam	SM	A–2
* Rock outcrop: 22. Properties are too variable to be estimated. For Tassel part, see Tassel series.				
* Rosebud: 23B, 23C, 24B, 24C, 24D	0–8	Fine sandy loam	SM	A–4
For Hargreave part of 23B and 23C, see Hargreave series; for Trelona part of 24B, 24C, and 24D, see Trelona series.	8–19	Sandy clay loam	SC	A–6
	19–32	Fine sandy loam	SM	A–4
	32	Bedrock.		
Sandstone outcrop: 25. Properties are too variable to be estimated.				
* Satanta: 26B, 26C, 27D	0–9	Fine sandy loam	ML or SM	A–4 or A–6
For Noden part of 26B and 26C, see Noden series; for Willowman part of 27D, see Willowman series; for Lambman part of 27D, see Lambman series.	9–19	Clay loam	CL	A–6
	19–60	Loam	ML	A–4
Tassel	0–16	Fine sandy loam	SM	A–4
Mapped only with Dwyer and Valent soils and Rock outcrop.	16	Bedrock.		
Torrifluvents-Fluvaquents: 28. Properties are too variable to be estimated.				
Torrifluvents-Fluvaquents, saline: 29. Properties are too variable to be estimated.				
Torriorthents, gullied: 30. Properties are too variable to be estimated.				
Trelona	0–14	Fine sandy loam	SM	A–4
Mapped only with Jayem, Manter, and Rosebud soils.	14	Bedrock.		
Ustic Torrifluvents, undulating: 31. Properties are too variable to be estimated.				
* Valent:				
Valent part of 32D and 32E For Dwyer part, see Dwyer series.	0–60	Fine sand	SM	A–2
Valent part of 33A, 33C, 5A, 5C, and 8D For Dwyer part of 33A and 33C, see Dwyer series.	0–60	Loamy fine sand	SM	A–2
Vetal: 34B, 34C	0–60	Fine sandy loam	SM	A–4
* Wendover: 35F	0–4	Very cobbly fine sandy loam	SM–SC or SC	A–2
Rock outcrop part is too variable to be estimated.	4–10	Very cobbly loam	CL–ML, CL, SM–SC, or SC	A–4
	10–18	Very cobbly sandy loam	SM–SC or SC	A–2
	18	Bedrock.		
Willowman	0–5	Gravelly fine sandy loam	SM–SC or SC	A–2 or A–4
Mapped only with Lambman and Satanta soils.	5–13	Gravelly sandy clay loam	SC	A–2
	13–60	Very gravelly sandy loam	GM	A–2
Wolf	0–4	Loam	CL or CL–ML	A–4 or A–6
Mapped only with Brownrigg and Featherlegs soils.	4–37	Clay loam	CL	A–6 or A–7
	37–60	Very gravelly sandy loam	GW	A–1

significant in engineering—Continued

Percentage passing sieve—				Permeability	Available water capacity	Reaction	Dispersion	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)					
				In per hr	*In per in of soil*	*pH*		
-------------	100	85–95	65–75	0.6–2.0	0.16–0.18	7.4–8.4	Moderate ---	Low.
40–55	35–50	30–45	25–35	0.6–2.0	0.08–0.10	6.6–7.8	Low -------	Moderate.
95–100	90–100	70–95	20–35	2.0–6.0	0.11–0.13	6.6–7.3	Low -------	Low.
95–100	90–100	80–100	40–55	0.6–2.0	0.14–0.16	6.6–7.3	Low -------	Moderate.
95–100	90–100	60–70	35–45	2.0–6.0	0.11–0.15	7.4–7.8	Low -------	Low.
90–100	85–95	50–80	25–30	6.0–20	0.09–0.13	7.4–8.4	Low -------	Low.
-------------	100	60–85	35–45	0.6–2.0	0.13–0.15	7.4–7.8	Low -------	Low.
-------------	100	70–85	40–50	0.6–2.0	0.14–0.16	7.4–7.8	Low -------	Moderate.
-------------	100	60–85	35–45	0.6–2.0	0.13–0.15	7.9–8.4	Low -------	Low.
-------------	100	70–85	40–55	0.6–2.0	0.13–0.15	6.6–7.8	Low -------	Low.
-------------	100	90–100	70–80	0.6–2.0	0.19–0.21	7.4–7.8	Moderate ---	Moderate.
-------------	100	85–95	60–75	0.6–2.0	0.16–0.18	7.8–8.4	Low -------	Low.
-------------	100	70–85	40–50	2.0–6.0	0.15–0.17	7.9–8.4	Low -------	Low.
90–100	90–100	70–80	40–50	2.0–6.0	0.13–0.15	7.4–7.8	Low -------	Low.
-------------	100	80–95	20–30	>20	0.07–0.12	7.4–7.8	Low -------	Low.
-------------	100	65–80	20–35	20	0.08–0.11	7.4–8.4	Low -------	Low.
-------------	100	70–85	40–50	2.0–6.0	0.12–0.15	7.4–7.8	Low -------	Low.
75–85	65–75	45–55	25–35	2.0–6.0	0.09–0.11	7.4–7.8	Low -------	Low.
85–95	75–85	65–70	45–55	2.0–6.0	0.06–0.08	7.9–8.4	Low -------	Low.
85–95	75–85	45–50	20–30	2.0–6.0	0.04–0.06	7.9–8.4	Low -------	Low.
65–75	60–70	50–60	30–40	0.6–2.0	0.11–0.13	7.4–7.8	Low -------	Low.
65–75	60–70	55–65	25–35	0.6–2.0	0.12–0.14	7.4–7.8	Low -------	Moderate.
40–50	40–50	30–35	15–20	0.6–2.0	0.07–0.09	7.9–8.4	Low -------	Low.
95–100	95–100	80–90	60–70	0.6–2.0	0.16–0.17	7.4–7.8	Low -------	Low.
95–100	95–100	85–95	65–75	0.6–2.0	0.17–0.19	7.4–9.0	Low -------	Moderate.
30–45	25–40	15–30	0–5	>20	0.04–0.06	7.9–8.4	Low -------	Low.

hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Dispersion refers to the degree that soil particles smaller than 0.005 millimeter are separate or dispersed. Dispersion excludes the single grained or unaggregated condition common in clean sand. Dispersed soils often slick over when wet and crust over when dry. They are unstable, and their use for engineering purposes is limited.

Shrink-swell potential is the relative change in volume of soil material to be expected with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to the maintenance of structures built in, on, or with material having this rating.

Salinity and depth to a seasonal high water table are significant for only a few soils in the survey area, and for this reason these properties are not given in table 4. Salinity is based on the electrical conductivity of saturated soil extract. It affects suitability of a soil for crops and for use as construction material. It also affects corrosivity to other materials.

Engineering interpretations

The estimated interpretations in table 5 are based on the engineering properties of soils shown in table 4, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of the northern part of Goshen County. In table 5, ratings are used to summarize the limitation or suitability of the soils for all listed purposes other than for irrigation; pond reservoirs; embankments, dikes, and levees; terraces and diversions; and grassed waterways. For these particular uses, table 5 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are expressed as *slight, moderate,* and *severe. Slight* means soil properties generally are favorable for the given use or, in other words, the limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties are so unfavorable and so difficult to correct or overcome that major soil reclamation and special designs are needed. *Very severe* means one or more soil properties are so unfavorable for a particular use that overcoming the limitations is most difficult and costly and commonly not practical for the rated use.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have meanings approximately parallel to the terms *slight, moderate,* and *severe.*

In the following paragraphs, the column headings in table 5 are explained.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as in preparing a seedbed; natural fertility of the material or plant response when fertilizer is added to the soil; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments affect suitability, and also considered in the ratings is damage that can result at the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source generally has a layer of sand or gravel at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and they do not indicate quality of the deposit.

Roadfill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Embankments, dikes, and levees require soil material that is resistant to seepage and piping and that is of favorable stability, shrink-swell potential, shear strength, and compactibility. Stones or organic material in a soil are among factors that are unfavorable.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulation of salts and alkali; depth of root zone; rate of water intake at the surface; permeability below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or to other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff, and establishing a plant cover on such a soil is not difficult.

Grassed waterways are natural or constructed waterways, typically broad and shallow, that are seeded to grass as protection against erosion. These waterways conduct surface water away from cropland.

Roads and streets have an all-weather surface expected to carry automobile traffic all year. They consist of a subgrade of underlying soil material; a base of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

The features that affect the rating of a soil for building foundations are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope affects layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage, within a depth of 2 to 5 feet, long enough for bacteria to decompose the solids. A lagoon has a nearly level floor; its sides, or embankments, are of soil material compacted to medium density, and the pond is protected from flooding. Properties that affect the pond floor are permeability, organic-matter content, and slope; if the floor needs to be leveled, depth to bedrock is also important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification, and the amount of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Formation and classification of the soils

This section discusses the major factors of soil formation as they relate to the soils of Goshen County, Northern Part, and the system of classifying soils into categories broader than the series.

Factors of soil formation

The properties of the soil at any given place result from the integrated effects of five major factors of soil formation: parent material, climate, plant and animal life, relief, and time.

Few generalizations can be made regarding the effect of any one factor, because the effect of each is modified by the other four.

Parent material

The soils in the survey area formed in three main kinds of parent material: residuum, eolian deposits, and alluvium. The nature of these materials is related to the geological formation from which they were derived.

During early geological time, the northern part of Goshen County periodically was covered by the sea. Each cycle of inundation and recession was accompanied by a period of deposition and erosion. Groups of sedimentary rock formed and eventually covered the basal Precambrian rock to a depth of several thousand feet. During Cretaceous time, the uplift that created the Hartville Hills tilted these sedimentary beds steeply upward toward the west. Subsequent cycles of deposition and erosion produced the Arikaree Formation. More recent eolian deposits, alluvium, and reexposures of this formation formed the present topography.

Harrison sandstone is the most important part of the Arikaree Formation. It is gray and soft and has small, pipy concretions. It is pervious and weathers rapidly. The moderately deep Rosebud and Hargreave soils and the shallow Tassel and Trelona soils formed in this material. This formation has contributed much material to local alluvial and eolian deposits.

The Brule Formation consists of pale pink to white, soft, blocky siltstone that weathers rapidly. Erosion removes the weathered material so rapidly that only shallow Epping soils and moderately deep Keota soils have formed in it. Most of the material weathered from the Brule Formation has become part of the local alluvial deposits and medium textured eolian deposits. Mitchell soils formed in this material.

The eolian deposits in this area are coarse textured, moderately coarse textured, and medium textured. The coarse textured deposits are low in clay, are calcareous, and are rapidly permeable. Most of these deposits are derived from Harrison sandstone. Some deposits that mantle terraces on the north side of the North Platte River are alluvium that has been reworked by wind. Dwyer and Valent soils formed in this material. These soils are deep but lack genetic horizons.

Local alluvium occurs in swales and shallow drainageways, on fans and foot slopes, and on flood plains of some intermittent and small perennial streams. Most of this material has been moved only a short distance from its source. It is generally uniform and unstratified and retains many characteristics of the original material. Dailey and Dwyer soils formed in coarse textured alluvium or eolian deposits. Bordeaux soils formed in moderately coarse textured eolian deposits. Vetal soils formed in moderately coarse textured alluvium, and Mitchell soils formed in medium textured alluvium.

High alluvial terraces occur in the northwestern part of the survey area. The deep Featherlegs and Wolf soils are underlain by detritus from the mountains, and the shallow Brownrigg soils formed in this colluvium.

The Hartville uplift produced the steep slopes on which the shallow Motoqua soils formed in material

TABLE 5.—*Engineering*

[In the first column, an asterisk before the series name indicates that at least one mapping unit in that series is made up of two necessary to refer to the

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Roadfill	Embankments, dikes, and levees	Pond reservoir areas
Albinas: 1B	Fair: too clayey.	Unsuited	Fair: shrink-swell potential.	Low strength, piping.	0 to 2 percent slopes: seepage. More than 2 percent slopes: seepage; slope.
Alice: 2B, 2C	0 to 8 percent slopes: good. 8 to 10 percent slopes: fair.	Unsuited	Fair: low strength.	Fair to poor, low strength, piping.	0 to 2 percent slopes: seepage. More than 2 percent slopes: seepage; slope.
Ascalon Mapped only with Jayem and Manter soils.	0 to 8 percent slopes: good. More than 8 percent slopes: fair.	Unsuited	Fair: low strength.	Piping, low strength.	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
Bordeaux: 3A, 3C	0 to 8 percent slopes: good. 8 to 10 percent slopes: fair; slope.	Unsuited	Fair: low strength; frost action potential.	Piping, hard to pack.	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
*Brownrigg: 4E For Featherlegs part, see Featherlegs series; for Wolf part, see Wolf series.	Poor: thin layer; small stones.	Unsuited	Poor: thin layer; large stones; frost action potential.	Large stones, thin layer.	Depth to rock; slope.
*Dailey: 5A, 5C For Valent part, see Valent series.	Poor: too sandy.	Fair for sand, unsuited for gravel.	Good	Piping, seepage	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.

interpretations

or more kinds of soil. The soils in such mapping units can have different properties and limitations, and for this reason it is other series as indicated]

Soil features affecting—Continued			Degree and kind of soil limitation for—			
Irrigation	Terraces and diversions	Grassed waterways	Roads and streets	Building foundations	Septic tank absorption fields	Sewage lagoons
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Favorable	Favorable	Moderate: shrink-swell potential.	Moderate: shrink-swell potential.	Slight	Moderate for 0 to 2 percent slopes: seepage. Moderate for 2 to 6 percent slopes: slope; seepage.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Erodes easily; piping.	Erodes easily	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: slope; low strength.	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: slope; low strength.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Moderate for 0 to 2 percent slopes: seepage. Moderate for 2 to 7 percent slopes: slope; seepage. Severe for 7 to 10 percent slopes: slope.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope; erodes easily.	Erodes easily; piping.	Erodes easily	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: slope; low strength.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Moderate for 0 to 2 percent slopes: seepage. Moderate for 2 to 7 percent slopes: slope; seepage. Severe for 7 to 10 percent slopes: slope.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Piping	Favorable	Moderate for 0 to 8 percent slopes: low strength; frost action potential. Moderate for 8 to 10 percent slopes: slope; low strength; frost action potential.	Moderate for 0 to 8 percent slopes: low strength; frost action potential. Moderate for 8 to 10 percent slopes: slope; low strength; frost action potential.	Moderate for 0 to 8 percent slopes: percs slowly. Moderate for 8 to 10 percent slopes: slope; percs slowly.	Moderate for 0 to 2 percent slopes: seepage. Moderate for 2 to 7 percent slopes: slope; seepage. Severe for 7 to 10 percent slopes: slope.
Complex slopes.	3 to 10 percent slopes: depth to rock. More than 10 percent slopes: slope; depth to rock.	3 to 10 percent slopes: rooting depth. More than 10 percent slopes: slope; rooting depth.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes; slope; depth to rock.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 7 percent slopes: depth to rock; small stones. Severe for more than 7 percent slopes: slope; depth to rock; small stones.
Complex slope; erodes easily; droughty.	Complex slope; too sandy; erodes easily.	Erodes easily; droughty.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Severe for 0 to 7 percent slopes: seepage. Severe for 7 to 10 percent slopes: slope; seepage.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Roadfill	Embankments, dikes, and levees	Pond reservoir areas
* Dix: 6C, 6E For Alice part, see Alice series.	Poor: small stones.	Good	0 to 15 percent slopes: good. 15 to 25 percent slopes: fair; slope. More than 25 percent slopes: poor; slope.	Seepage	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
Dune land: 7. Properties are too variable to rate.					
* Dwyer: 8D For Valent part, see Valent series; for Tassel part, see Tassel series.	0 to 8 percent slopes: poor; too sandy. More than 8 percent slopes: poor; slope; too sandy.	Fine sand: fair for sand. Loamy fine sand: poor for sand; unsuited for gravel.	0 to 15 percent slopes: good. More than 15 percent slopes: fair; slope.	Seepage, piping	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
Embry: 9A, 9C	0 to 8 percent slopes: good. 8 to 10 percent slopes: fair; slope.	Sand: poor; excess fines; unsuited for gravel.	Good	Piping	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
Epping: 10C	Poor: thin layer.	Unsuited	Poor: thin layer.	Low strength, thin layer.	0 to 2 percent slopes: depth to rock. More than 2 percent slopes: depth to rock.
* Featherlegs: 11B, 11C, 12C For Wolf part, see Wolf series; for Brownrigg part of 12C, see Brownrigg series.	0 to 8 percent slopes: fair; too clayey. 8 to 10 percent slopes: fair; slope; too clayey.	Good	Good	Low strength	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
* Hargreave: 13B, 13C For Noden part, see Noden series.	0 to 8 percent slopes: fair; too clayey. 8 to 10 percent slopes: fair; slope; too clayey.	Poor: excess fines for sand; unsuited for gravel.	Poor: thin layer.	Piping, low strength, thin layer.	0 to 2 percent slopes: depth to rock; seepage. More than 2 percent slopes: slope; depth to rock; seepage.

interpretations—Continued

Soil features affecting—Continued			Degree and kind of soil limitation for—			
Irrigation	Terraces and diversions	Grassed waterways	Roads and streets	Building foundations	Septic tank absorption fields	Sewage lagoons
0 to 2 percent slopes: seepage; droughty. More than 2 percent slopes: slope; seepage; droughty.	0 to 10 percent slopes: erodes easily. More than 10 percent slopes: slope; erodes easily.	0 to 10 percent slopes: droughty; erodes easily. More than 10 percent slopes: slope; droughty; erodes easily.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Severe for 0 to 7 percent slopes: seepage. Severe for more than 7 percent slopes: slope; seepage.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	0 to 10 percent slopes: seepage; piping. More than 10 percent slopes: slope; seepage; piping.	0 to 10 percent slopes: droughty; erodes easily. More than 10 percent slopes: slope; droughty; erodes easily.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Severe for 0 to 7 percent slopes: seepage. Severe for more than 7 percent slopes: slope; seepage.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Too sandy; piping.	Favorable	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: slope; low strength.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Severe for 2 to 7 percent slopes: seepage. Severe for 7 to 10 percent slopes: slope; seepage.
0 to 2 percent slopes: rooting depth. More than 2 percent slopes: rooting depth.	Depth to rock	Rooting depth.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe for 0 to 7 percent slopes: depth to rock. Severe for 7 to 10 percent slopes: depth to rock.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Favorable	Favorable	Severe: low strength.	Moderate for 0 to 8 percent slopes: low strength; shrink-swell. Moderate for 8 to 10 percent slopes: slope; low strength; shrink-swell.	Moderate for 0 to 8 percent slopes: percs slowly. Moderate for 8 to 10 percent slopes: slope; percs slowly.	Moderate for 0 to 2 percent slopes: seepage. Moderate for 2 to 7 percent slopes: seepage. Severe for 7 to 10 percent slopes: slope.
0 to 2 percent slopes: rooting depth. More than 2 percent slopes: rooting depth.	Depth to rock	Rooting depth.	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: slope; low strength.	Moderate for 0 to 8 percent slopes: depth to rock. Moderate for 8 to 10 percent slopes: slope; depth to rock.	Severe: depth to rock.	Severe for 0 to 7 percent slopes: depth to rock. Severe for 7 to 10 percent slopes: slope; depth to rock.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Roadfill	Embankments, dikes, and levees	Pond reservoir areas
*Jayem: 14A, 14C, 15C, 16D For Ascalon part of 15C, see Ascalon series; for Manter part of 15C and 16D, see Manter series; for Trelona part of 16D, see Trelona series.	0 to 8 percent slopes: good. 8 to 10 percent slopes: fair; slope.	Poor for sand: excess fines; unsuited for gravel.	Fair: low strength.	Low strength, piping.	0 to 2 percent slopes: seepage. More than 2 percent slopes: seepage; slope.
*Keota: 17B, 18C For Epping part of 18C, see Epping series.	0 to 8 percent slopes: good. 8 to 10 percent slopes: fair; slope.	Unsuited	Poor: thin layer.	Thin layer, low strength, piping.	0 to 2 percent slopes: depth to rock; seepage. More than 2 percent slopes: slope; depth to rock; seepage.
Lambman Mapped only with Satanta and Willowman soils.	3 to 8 percent slopes: fair; too clayey. 8 to 15 percent slopes: fair; slope; too clayey. More than 15 percent slopes: poor; slope.	Unsuited	Poor: thin layer.	Thin layer, low strength.	Depth to rock; slope.
Manter Mapped only with Ascalon, Jayem, and Trelona soils.	0 to 8 percent slopes: good. 8 to 10 percent slopes: fair; slope.	Sand: poor, excess fines; unsuited for gravel.	Fair: low strength, frost action.	Piping, low strength.	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
Mitchell: 19B, 19C, 19D	0 to 8 percent slopes: good. 8 to 15 percent slopes: fair; slope. More than 15 percent slopes: poor; slope.	Unsuited	0 to 15 percent slopes: fair; low strength. More than 15 percent slopes: fair; slope; low strength.	Low strength, piping.	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
*Motoqua: 20F Rock outcrop part is too variable to be estimated.	Poor: slope; small stones; area reclaim.	Unsuited	Poor: slope; thin layer.	Large stones, thin layer.	Depth to rock; slope.
Noden Mapped only with Hargreave and Satanta soils.	0 to 8 percent slopes: fair; too clayey. 8 to 10 percent slopes: fair; slope; too clayey.	Unsuited	Fair: low strength.	Piping, low strength.	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.

interpretations—Continued

Soil features affecting—Continued			Degree and kind of soil limitation for—			
Irrigation	Terraces and diversions	Grassed waterways	Roads and streets	Building foundations	Septic tank absorption fields	Sewage lagoons
0 to 2 percent slopes: erodes easily. More than 2 percent slopes: slope; erodes easily.	Erodes easily, piping.	Erodes easily	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: slope; low strength.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Severe for 0 to 7 percent slopes: seepage. Severe for 7 to 10 percent slopes: slope; seepage.
Rooting depth, complex slopes.	Depth to rock, complex slopes, piping.	Depth to rock, erodes easily, complex slopes.	Moderate for 0 to 8 percent slopes: low strength; depth to rock. Moderate for 8 to 10 percent slopes: low strength; slope; depth to rock.	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: low strength; slope; depth to rock.	Severe: depth to rock.	Severe for 0 to 7 percent slopes: depth to rock; seepage. Severe for 7 to 10 percent slopes: depth to rock; slope; seepage.
Rooting depth, slope.	3 to 10 percent slopes: depth to rock. More than 10 percent slopes: slope; depth to rock.	3 to 10 percent slopes: rooting depth. More than 10 percent slopes: rooting depth.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 7 percent slopes: depth to rock. Severe for more than 7 percent slopes: slope; depth to rock.
0 to 2 percent slopes: erodes easily. More than 2 percent slopes: slope; erodes easily.	Erodes easily, piping.	Erodes easily, frost action.	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: low strength; slope; frost action.	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: low strength; slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Severe for 0 to 7 percent slopes: seepage. Severe for 7 to 10 percent slopes: slope; seepage.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	0 to 10 percent slopes: erodes easily; piping. More than 10 percent slopes: slope; erodes easily; piping.	0 to 10 percent slopes: erodes easily; slope. More than 10 percent slopes: slope; erodes easily; piping.	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 15 percent slopes: slope; low strength. Severe for more than 15 percent slopes: slope.	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 15 percent slopes: low strength; slope. Severe for more than 15 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Moderate for 0 to 7 percent slopes: seepage; slope. Severe for more than 7 percent slopes; slope.
Slope, rooting depth.	Slope, depth to rock.	Slope, rooting depth.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Piping	Favorable	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: slope; low strength.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Moderate for 0 to 2 percent slopes: seepage. Moderate for 2 to 7 percent slopes: seepage; slope. Severe for 7 to 10 percent slopes: slope.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Roadfill	Embankments, dikes, and levees	Pond reservoir areas
Otero: 21B, 21C	0 to 8 percent slopes: good. 8 to 10 percent slopes: fair; slope.	Poor for sand, excess fines; unsuited for gravel.	Good	Piping	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
* Rock outcrop: 22. Properties are too variable to rate. For Tassel part, see Tassel series.					
* Rosebud: 23B, 23C, 24B, 24C, 24D. For Hargreave part of 23B and 23C, see Hargreave series; for Trelona part of 24B, 24C, and 24D, see Trelona series.	0 to 8 percent slopes: fair; too clayey. 8 to 15 percent slopes: fair; slope; too clayey. More than 15 percent slopes: severe; slope.	Unsuited	Poor: thin layer.	Piping, shrink-swell, thin layer.	0 to 2 percent slopes: depth to rock. More than 2 percent slopes: slope; depth to rock.
Sandstone outcrop: 25. Properties are too variable to rate.					
* Satanta: 26B, 26C, 27D For Noden part of 26B and 26C, see Noden series; for Willowman part of 27D, see Willowman series; for Lambman part of 27D, see Lambman series.	0 to 8 percent slopes: fair; too clayey. 8 to 10 percent slopes: slope; too clayey.	Unsuited	Fair: shrink-swell. low strength.	Shrink-swell, low strength.	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.
Tassel Mapped only with Dwyer and Valent soils and Rock outcrop.	3 to 15 percent slopes: poor; thin layer. More than 15 percent slopes: poor; slope; thin layer.	Unsuited	Poor: thin layer.	Thin layer, piping.	Depth to rock; slope, seepage.
Torrifluvents-Fluvaquents: 28. Properties are too variable to rate.					
Torrifluvents-Fluvaquents, saline: 29. Properties are too variable to rate.					
Torriorthents, gullied: 30. Properties are too variable to rate.					

interpretations—Continued

Soil features affecting—Continued			Degree and kind of soil limitation for—			
Irrigation	Terraces and diversions	Grassed waterways	Roads and streets	Building foundations	Septic tank absorption fields	Sewage lagoons
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Piping	Favorable	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Severe for 0 to 7 percent slopes: seepage. Severe for 7 to 10 percent slopes: slope; seepage.
0 to 2 percent slopes: rooting depth. More than 2 percent slopes: slope; rooting depth.	0 to 10 percent slopes: depth to rock; piping. More than 10 percent slopes: slope; depth to rock; piping.	0 to 10 percent slopes: rooting depth. More than 10 percent slopes: slope; rooting depth.	Moderate for 0 to 8 percent slopes: depth to rock; shrink-swell. Moderate for 8 to 15 percent slopes: slope; depth to rock; shrink-swell. Severe for more than 15 percent slopes: slope.	Moderate for 0 to 8 percent slopes: depth to rock; shrink-swell. Moderate for 8 to 15 percent slopes: slope; depth to rock; shrink-swell. Severe for more than 15 percent slopes: slope.	Severe for 0 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 0 to 7 percent slopes: depth to rock. Severe for more than 7 percent slopes: slope; depth to rock.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Favorable	Favorable	Moderate for 0 to 8 percent slopes: shrink-swell; low strength. Moderate for 8 to 10 percent slopes: shrink-swell; low strength; slope.	Moderate for 0 to 8 percent slopes: shrink-swell; low strength. Moderate for 8 to 10 percent slopes: slope; shrink-swell; low strength.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Moderate for 0 to 2 percent slopes: seepage. Moderate for 2 to 7 percent slopes: seepage; slope. Severe for 7 to 10 percent slopes: slope.
Rooting depth, slope.	3 to 10 percent slopes: depth to rock; piping. More than 10 percent slopes: slope; depth to rock; piping.	3 to 10 percent slopes: rooting depth. More than 10 percent slopes: rooting depth.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 7 percent slopes: depth to rock; seepage. Severe for more than 7 percent slopes: slope; depth to rock; seepage.

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—	
	Topsoil	Sand and gravel	Roadfill	Embankments, dikes, and levees	Pond reservoir areas
Trelona Mapped only with Jayem, Manter, and Rosebud soils.	3 to 15 percent slopes: poor; thin layer. More than 15 percent slopes: poor; thin layer; slope.	Unsuited	Poor: thin layer.	Low strength, thin layer.	Depth to rock, slope.
Ustic Torriorthents, undulating: 31. Properties are too variable to rate.					
* Valent: 32D, 32E, 33A, 33C. For Dwyer part, see Dwyer series.	0 to 15 percent slopes: poor; too sandy. More than 15 percent slopes: poor; slope; too sandy.	Poor for sand, excess fines; unsuited for gravel.	0 to 15 percent slopes: good. 15 to 25 percent slopes: fair; slope. More than 25 percent slopes: poor; slope.	Piping, seepage	0 to 2 percent slopes: seepage. More than 2 percent slopes: seepage.
Vetal: 34B, 34C	0 to 8 percent slopes: good. 8 to 10 percent slopes: fair; slope.	Poor: excess fines for sand; unsuited for gravel.	Fair: low strength.	Piping	0 to 2 percent slopes: seepage. More than 2 percent slopes: seepage.
* Wendover: 35F Rock outcrop part is too variable to be estimated.	Poor: small stones, thin layer.	Unsuited	10 to 25 percent slopes: poor; thin layer, area reclaim. More than 25 percent slopes: poor; slope, thin layer, area reclaim.	Thin layer	Depth to rock, slope.
Willowman Mapped only with Lambman and Satanta soils.	3 to 15 percent slopes: poor; small and large stones. Poor for more than 15 percent slopes: slope; small and large stones.	Poor for gravel, excess fines; unsuited for sand.	Fair: large stones.	Large stones	Seepage, slope
Wolf Mapped only with Brownrigg and Featherlegs soils.	0 to 8 percent slopes: fair; too clayey. 8 to 10 percent slopes: fair; too clayey; slope.	Unsuited	Poor: low strength.	Low strength	0 to 2 percent slopes: seepage. More than 2 percent slopes: slope; seepage.

interpretations—Continued

Soil features affecting—Continued			Degree and kind of soil limitation for—			
Irrigation	Terraces and diversions	Grassed waterways	Roads and streets	Building foundations	Septic tank absorption fields	Sewage lagoons
Rooting depth, slope.	3 to 10 percent slopes: depth to rock. More than 10 percent slopes: slope; depth to rock.	3 to 10 percent slopes: rooting depth. More than 10 percent slopes: slope; rooting depth.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 3 to 7 percent slopes: depth to rock. Severe for more than 7 percent slopes: slope; depth to rock.
0 to 2 percent slopes: droughty. More than 2 percent slopes: slope; droughty.	0 to 10 percent slopes: erodes easily; piping. More than 10 percent slopes: slope; erodes easily; piping.	0 to 10 percent slopes: erodes easily. More than 10 percent slopes: slope; erodes easily.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 15 percent slopes: slope. Severe for more than 15 percent slopes: slope.	Severe for 0 to 7 percent slopes: seepage. Severe for more than 7 percent slopes: slope; seepage.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Erodes easily, piping.	Erodes easily	Moderate for 0 to 8 percent slopes: low strength. Moderate for 8 to 10 percent slopes: slope; low strength.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Slight for 0 to 8 percent slopes. Moderate for 8 to 10 percent slopes: slope.	Severe for 0 to 7 percent slopes: seepage. Severe for 7 to 10 percent slopes: slope; seepage.
Slope, rooting depth.	Depth to rock, slope.	Slope, rooting depth.	Severe for 10 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 10 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe for 10 to 15 percent slopes: depth to rock. Severe for more than 15 percent slopes: slope; depth to rock.	Severe: slope; depth to rock.
Complex slope.	3 to 10 percent slopes: large stones. More than 10 percent slopes: slope; large stones.	3 to 10 percent slopes: large stones. More than 10 percent slopes: slope; large stones.	Moderate for 3 to 8 percent slopes: large stones; shrink-swell. Moderate for 8 to 15 percent slopes: slope; large stones; shrink-swell. Severe for more than 15 percent slopes: slope.	Severe for 3 to 15 percent slopes: large stones. Severe for 15 to 20 percent slopes: slope; large stones.	Severe for 3 to 15 percent slopes: large stones. Severe for 15 to 20 percent slopes: slope; large stones.	Moderate for 3 to 7 percent slopes: large stones; slope; seepage. Severe for more than 7 percent slopes: slope.
0 to 2 percent slopes: favorable. More than 2 percent slopes: slope.	Favorable	Favorable	Severe: low strength.	Moderate for 0 to 8 percent slopes: low strength; shrink-swell. Moderate for 8 to 10 percent slopes: low strength; shrink-swell.	Moderate for 0 to 8 percent slopes: percs slowly. Moderate for 8 to 10 percent slopes: slope; percs slowly.	Moderate for 0 to 2 percent slopes: seepage. Moderate for 2 to 7 percent slopes: slope; seepage. Severe for 7 to 10 percent slopes: slope.

weathered from metamorphic and igneous rocks and the steep slopes on which the shallow Wendover soils formed in material weathered from sedimentary rocks. The deep, skeletal Willowman soil formed in colluvium on mountain toe slopes and foot slopes. Albinas soils formed in the local alluvium of this area.

Climate

Climate has been an active force in the accumulation of parent material through the weathering of rocks, the transportation of unconsolidated material by streams, and the effects of wind and heavy rain. Relief, time, and parent material have modified the effect of the climate in this area on such soil-forming processes as leaching and translocation of clay. Many of the young soils, such as Mitchell, Otero, and Dwyer soils, formed in calcareous materials and have not been leached. Vetal soils formed in noncalcareous materials but may have been leached because of their position on the landscape. Many of the soils have been leached. Except for Hargreave, Jayem, and Noden soils, all have an accumulation of secondary calcium carbonate. The depth to this zone ranges from about 9 to 40 inches but averages 24 inches, which is the average depth of water percolation and leaching. Albinas, Ascalon, Brownrigg, Featherlegs, Hargreave, Lambman, Manter, Motoqua, Noden, Rosebud, Satanta, Wendover, Willowman, and Wolf soils have a horizon of clay accumulation. This accumulation resulted either from the decomposition of minerals in place or the translocation of clay by water from the surface layer to the subsoil or both. This zone is about 10 inches thick and occurs at an average depth of about 8 inches.

Plant and animal life

The original vegetation in this area was mainly short, mid, and tall grasses. A few scattered shrubs and trees grew in the mountainous areas and on steep breaks. Noden, Rosebud, and Satanta soils reflect the influence of grass vegetation. They have dark colored, neutral to mildly alkaline, granular surface layers. Climate affects the activity of micro-organisms and earthworms. Most of the survey area, however, is too dry for earthworms.

Relief

Relief influences soil formation by affecting runoff and drainage. Soil-forming processes are much slower on steep slopes than on gentle slopes. Runoff is rapid, and erosion removes soil material as it forms. Most steeply sloping soils are weakly developed and are generally shallow. Tassel and Trelona soils are typical shallow, steeply sloping soils.

Well drained soils in swales and depressions receive runoff from higher lying slopes. This additional moisture causes an increase in plant growth and in the activity of micro-organisms. It makes the soils more suitable for earthworms. The Albinas and Vetal soils on foot slopes and in drainageways have a thicker A horizon and are more deeply leached than the soils that formed in similar material on adjoining slopes.

Time

Time is needed for soils to develop genetic horizons. The length of time varies with climate, vegetation, parent material, and relief. The older soils in northern Goshen County have distinct horizons and an accumulation of organic matter, clay, and calcium carbonate. Examples are the Albinas, Ascalon, Featherlegs, Hargreave, Manter, Noden, Rosebud, Satanta, and Wolf soils.

In some younger soils the only evidence of soil development is a slight darkening in the upper inch or so of the surface layer. Included in this group are Embry, Epping, Keota, Mitchell, and Otero soils. Other younger soils, such as Alice, Bordeaux, Jayem, and Vetal soils, have a dark colored surface layer that formed in an accumulation of organic matter. Some have a thin zone of calcium carbonate accumulation but do not have a zone of clay accumulation.

The Torrifluvents-Fluvaquents complex and Ustic Torrifluvents, undulating, have not been in place long enough for genetic horizons to develop. Dailey, Dwyer, and Valent soils are weakly developed because of the young, coarse-textured eolian parent material. Tassel and Trelona soils lack prominent genetic horizons because of the continual geologic erosion on the steep slopes.

Classification of the soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 and revised later (*6*). The system currently used by the National Cooperative Soil Survey was developed in the early sixties (*5*) and was adopted in 1965 (*8*). It is under continual study.

The current system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available.

Table 6 shows the classification of each soil series of the northern part of Goshen County by family, subgroup and great group, and order, according to the current system.

General nature of the area

The physiography, the relief and drainage, the climate, the history and development, and the farming of the northern part of Goshen County are discussed in this section.

TABLE 6.—*Classification of soil series by higher categories*

Soil series	Family	Subgroup and great group	Order
Albinas	Fine-loamy, mixed, mesic	Pachic Argiustolls	Mollisols.
Alice	Coarse-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Ascalon	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Bordeaux	Coarse-loamy, mixed, mesic	Torriorthentic Haplustolls	Mollisols.
Brownrigg	Loamy-skeletal, mixed, mesic, shallow	Aridic Argiustolls	Mollisols.
Dailey	Sandy, mixed, mesic	Torriorthentic Haplustolls	Mollisols.
Dix	Sandy-skeletal, mixed, mesic	Torriorthentic Haplustolls	Mollisols.
Dwyer	Mixed, mesic	Ustic Torripsamments	Entisols.
Embry	Coarse-loamy, mixed, nonacid, mesic	Ustic Torriorthents	Entisols.
Epping	Loamy, mixed, calcareous, mesic, shallow	Ustic Torriorthents	Entisols.
Featherlegs	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Hargreave	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Jayem	Coarse-loamy, mixed, mesic	Aridic Haplustolls	Mollisols.
Keota	Coarse-silty, mixed, calcareous, mesic	Ustic Torriorthents	Entisols.
Lambman	Loamy, mixed, mesic, shallow	Aridic Argiustolls	Mollisols.
Manter	Coarse-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Mitchell	Coarse-silty, mixed, calcareous, mesic	Ustic Torriorthents	Entisols.
Motoqua	Loamy-skeletal, mixed, mesic	Lithic Argiustolls	Mollisols.
Noden	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Otero	Coarse-loamy, mixed, calcareous, mesic	Ustic Torriorthents	Entisols.
Rosebud	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Satanta	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.
Tassel	Loamy, mixed, calcareous, mesic, shallow	Ustic Torriorthents	Entisols.
Trelona	Loamy, mixed, mesic, shallow	Torriorthentic Haplustolls	Mollisols.
Valent	Mixed, mesic	Ustic Torripsamments	Entisols.
Vetal	Coarse-loamy, mixed, mesic	Pachic Haplustolls	Mollisols.
Wendover	Loamy-skeletal, mixed, mesic	Lithic Argiustolls	Mollisols.
Willowman	Loamy-skeletal, mixed, mesic	Aridic Argiustolls	Mollisols.
Wolf	Fine-loamy, mixed, mesic	Aridic Argiustolls	Mollisols.

Physiography, relief, and drainage

The survey area is in the High Plains section of the Great Plains province. Elevation ranges from 4,200 to 6,135 feet. The principal drainageway is Rawhide Creek.

Areas of nearly level to steep sands and sand hills are in the southeastern part of the survey area north of the Interstate Canal. A narrow band of these soils extends along the canal to Fort Laramie and a few miles further north. These areas also occur in the northeastern part of the survey area—northwest and northeast of Prairie Center and in the Lone Sandhill area. Drainageways generally are closed, and most of the rainfall and runoff soaks in. Another area is west of Highway 85 in the central part of the survey area. This area is drained by Sage Creek.

The soils in area T. 26 N., which extends from the Nebraska State line to Rawhide Creek, are on a nearly level to moderately steep, smooth, rolling terrace that is drained on the east by Sheep Creek and on the west by Rawhide Creek.

The central section of the survey area is drained by Rawhide Creek and its tributaries. This area consists of undulating and gently rolling tableland and rolling to steep hills. The tableland is 100 to 600 feet higher than the Rawhide Creek bottom.

The southwestern part of the survey area, which extends from the Platte County line to Rawhide Creek, is characterized by steep, dissected topography. Numerous water courses, including County Line Draw, Cottonwood Draw, Molly Fork, and Sand Draw, are in the area. Some prominent hills in this area are Pine Ridge and Casebier Hill.

In the northwestern part is a broad, nearly level to gently rolling, dissected terrace that is adjacent to Wildcat Hills. This terrace parallels the hills and extends eastward for 6 to 10 miles. It is more dissected and rolling with distance eastward. Muskrat and Rawhide Creeks drain this area.

The western part of the survey area consists of steep and rugged hills, including Haystack Range and Rawhide Mountain. The Wildcat Hills are also in this part of the survey area, but they are not rugged—they have rounded topography. These hills are about 22 miles long, running north and south, and 2 to 6 miles wide. There are several canyons. These hills are drained on the east by Rawhide and Muskrat Creeks and on the west by Broom Creek. The highest elevation in the survey area is in this part.

Climate

The climate in the survey area is semiarid. The high elevation and the dry air cause wide variations in temperature between summer and winter and in the daily maximum and minimum. Freezing temperatures late in spring and early in fall are common.

The climate in the survey area is affected by the Laramie Range, which is about 55 miles west of the survey area. The Laramie Range runs north and south and is about 9,000 feet high. The terrain gradually slopes upward to the west for 45 miles and then rises abruptly into the range. The predominantly westerly winds moving downslope warm the air as it is compressed at the lower elevation. Cold air is seldom trapped, because it tends to move to the east in the direction of the prevailing winds.

The lowest temperatures occur when cold air from Canada flows into the survey area. There are no mountains to the north to block the passage of cold air masses from Canada southward. The Black Hills are about 100 miles to the north but have no significant effect on the climate. The weather varies widely and sometimes changes abruptly. The outbreaks of cold air from Canada generally do not last long. They flow mostly to the southeast and east, and the survey area is in the path of the western edge of the cold air for only a limited time.

Table 7 gives temperature and precipitation data from two weather stations just outside the survey area. It also shows probabilities of specified temperatures and amounts of precipitation. Further probabilities are given in Bulletins 415 (*3*) and 416 (*4*) compiled at the University of Wyoming Agricultural Experiment Station. Table 8 shows the average date of the last freezing temperature in spring and the first in fall.

The growing season, which extends from the last temperature of 32° F. in spring to the first in fall, averages 115 days at Lusk and 127 days at the Torrington Experiment Farm. The growing season which extends from the last temperature of 28° in spring to the first in fall, averages 137 days at Lusk and 148 days at the Torrington Experiment Farm.

Precipitation is lightest in December, January, and February and heaviest in the last part of May and the first part of June. It reaches another low by August and then becomes heavy again about the middle of September. Precipitation of 1.4 inches or more in a

TABLE 7.—*Temperature and precipitation data*

[Data based on records from 1931 through 1960 at Torrington Experiment Farm, elevation 4,098 feet, and at Lusk, elevation 5,006 feet. Dashes mean that data were not available]

Month	Temperature					Precipitation				Mean number of days with—		
				Two years in 10 will have at least 4 days with—			One year in 10 will have—					
	Mean daily maximum	Mean daily minimum	Monthly mean	Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—	Mean total	Less than—	More than—	Snow and sleet, mean total	Precipitation of 0.10 inch or more	Maximum temperature of 90°F and above	Minimum temperature of 0°F and below
	°F	*°F*	*°F*	*°F*	*°F*	*In*	*In*	*In*	*In*			
Torrington Experiment Farm:												
January	40.9	12.0	26.5	59	−11	0.28	0.02	0.74	4.6	1	0	6
February	44.5	14.9	29.7	64	−6	.39	.03	.81	5.9	1	0	3
March	50.1	21.2	35.7	70	2	.76	.24	1.45	7.5	2	0	2
April	61.5	30.7	46.1	80	16	1.80	.70	3.95	4.0	4	0	(1)
May	70.8	41.2	56.0	87	30	2.55	.87	4.46	.7	6	1	0
June	81.2	50.1	65.7	96	40	2.75	.78	6.39	.1	5	7	0
July	89.3	55.9	72.6	99	49	1.41	.34	3.09	0	3	16	0
August	87.3	53.5	70.4	97	44	.95	.29	1.90	0	3	13	0
September	78.5	42.5	60.5	92	31	1.01	.15	1.83	0	3	4	0
October	67.5	31.7	49.5	83	19	.72	.08	1.62	.7	2	(1)	0
November	51.7	20.4	36.1	69	3	.47	.06	1.15	4.3	2	0	2
December	43.8	14.9	29.4	62	−4	.43	.05	.92	5.3	1	0	1
Year	63.9	32.4	48.2	----	----	13.52	----	----	33.1	33	41	14
Lusk:												
January	35.9	12.4	24.2	----	----	0.49	----	----	7.9	1	0	6
February	39.0	14.5	26.8	----	----	.50	----	----	7.9	2	0	4
March	45.3	20.0	32.7	----	----	.82	----	----	10.3	3	0	2
April	57.1	29.5	43.3	----	----	1.91	----	----	8.2	5	0	(1)
May	67.0	39.2	53.1	----	----	2.68	----	----	1.7	6	(1)	0
June	77.5	47.8	62.7	----	----	2.80	----	----	.5	6	3	0
July	87.2	54.0	70.6	----	----	1.56	----	----	0	4	13	0
August	85.6	52.2	68.9	----	----	1.11	----	----	0	3	11	0
September	75.9	42.1	59.0	----	----	1.14	----	----	.5	3	2	0
October	63.6	32.4	48.0	----	----	.87	----	----	2.5	2	0	(1)
November	46.5	21.5	34.0	----	----	.62	----	----	8.2	2	0	1
December	39.0	16.1	27.6	----	----	.50	----	----	8.1	2	0	3
Year	60.0	31.8	45.9	----	----	15.00	----	----	55.8	39	29	16

[1] Less than half a day.

TABLE 8.—*Probabilities of last freezing temperature in spring and first in fall*

[Data from Torrington Experiment Farm]

Probability	Dates for given probability and temperature—				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	April 23	May 2	May 11	May 22	June 3
2 years in 10 later than	April 18	April 27	May 6	May 17	May 29
5 years in 10 later than	April 7	April 16	April 25	May 6	May 18
Fall:					
1 year in 10 earlier than	October 16	October 5	September 30	September 16	September 7
2 years in 10 earlier than	October 21	October 10	October 5	September 21	September 12
5 years in 10 earlier than	October 31	October 20	October 15	October 1	September 22

6-hour period is expected to recur about once in 2 years. Generally, about half of the annual precipitation falls between the date of the last temperature of 32° in spring and that of the first in fall, and about 60 percent falls between the date of the last temperature of 28° in spring and the date of the first in fall. Moisture from the Pacific Ocean is mostly blocked by numerous mountain chains that lie between the survey area and the ocean.

Sunshine is abundant. It averages 65 percent of the sunshine annually possible and ranges from about 55 percent in winter to 75 percent in summer.

The average windspeed is 13 miles an hour. The strongest winds occur during the period November through May. The average windspeed is 15 miles an hour in April and 10 miles an hour in August.

Relative humidity averages about 60 percent, ranging from about 55 percent in July to about 65 percent in January. The daily relative humidity in July ranges from about 80 percent at 5 a.m. to about 40 percent at 5 p.m. In January the humidity at those hours is 75 and 55 percent.

History and development

Fort William, the first settlement in Wyoming, was established in 1834 on the Laramie River near its junction with the North Platte River. The Federal government acquired the fort in 1849, renamed it Fort Laramie, and used it as an army post until 1890. Cattle ranchers arrived in the area in the late 1860's and early 1870's. Homesteaders settled here during the late 1870's and until about 1920.

Goshen County was established in 1911. Torrington is the county seat and the principal market and trading center. There are no railroads in the area. There is one Federal Highway and one State road for farm-to-market transportation and other maintained roads.

Farming and ranching

The northern part of Goshen County has a land area of 607,477 acres, and about 98 percent is used for farming and ranching. Of that acreage, about 4 percent is irrigated cropland, 6 percent dry cropland, and 88 percent rangeland.

Cattle ranching began about 1868. Cattle production increased in the 1870's, reached its peak in the early 1880's, and then declined rapidly. The main reasons for this decline were the severe overgrazing of rangeland, the disastrous winter of 1886-87, which killed many cattle, the introduction of sheep into the area, and the increasing number of homesteaders. Cattle ranching, however, has continued to be important.

Irrigation was begun by cattle ranchers who diverted water from streams onto adjacent bottom lands to grow hay and grain for winter feed. This method of irrigation is still used by many ranchers along live streams. Many farmers in the northern part of the survey area are drilling wells and irrigating with center-pivot sprinklers. A cooperative effort among farmers resulted in the construction of the Interstate Canal in 1915. This canal forms most of the southern boundary of the survey area. The canal is supplemented by good irrigation wells in the area north of the canal and in the area from Rawhide Creek to the Nebraska State line. Most of the irrigation water comes from wells. Ground water is available for irrigation only in the southern part of the area on the high terraces above the North Platte River, and in the northern part of the area where the water comes from sandstone.

The principal irrigated crops in the southern part of the area are sugar beets, corn, alfalfa, beans, and potatoes. Irrigated crops in the northern part of the area are mainly alfalfa, hay, and pasture.

Dryland farming began on a small scale in 1910 and increased until the severe drought in the early 1930's. A system of alternating strips of crops with summer fallow was adopted by the late 1930's. Since that time, dryland farming has been limited. The principal dryland crops are small grains, mainly winter wheat.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Evapotranspiration. That part of the root zone moisture which is consumed by evaporation and transpiration combined, including all water consumed by plants plus the water evaporated from bare land and water surface.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Leaching. The removal of soluble material from soil or other material by percolating water.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		pH
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope class. The slope classes used in this survey are as follows:

Percent	*Single Slopes*	*Complex Slopes*
0–3	Nearly level	Nearly level
0–6	Nearly level to gently sloping	Nearly level to undulating
0–10	Nearly level to sloping	Nearly level to rolling
3–10	Gently sloping to sloping	Undulating to rolling
3–20	Gently sloping to moderately steep	Undulating to hilly
6–10	Sloping	Rolling
10–20	Moderately steep	Hilly
10–40		Hilly to steep
10–60	Moderately steep to steep	
20–60	Steep	Steep

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that is can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. Capability grouping is explained beginning on page 30. Range site descriptions begin on page 36. Windbreak site descriptions begin on page 38.

Map symbol	Mapping unit	Page	Capability unit		Range site	Windbreak site
			Dryland Symbol	Irrigated Symbol	Name	Name
1B	Albinas loam, 0 to 6 percent slopes	6	IIIe-2	IIe-2	Loamy	Silty to clayey
2B	Alice fine sandy loam, 0 to 6 percent slopes	6	IIIe-5	IIe-5	Sandy	Sandy
2C	Alice fine sandy loam, 6 to 10 percent slopes	7	IVe-5	IIIe-5	Sandy	Sandy
3A	Bordeaux fine sandy loam, 0 to 3 percent slopes	7	IIIe-5	-------	Sandy	Sandy
3C	Bordeaux fine sandy loam, 3 to 10 percent slopes	8	IVe-5	-------	Sandy	Sandy
4E	Brownrigg-Featherlegs-Wolf complex, 10 to 40 percent slopes	8	VIIe-14	-------	--------------	---------------
	Brownrigg part	--	--------	-------	Shallow loamy	Unsuitable
	Featherlegs part	--	--------	-------	Loamy	Silty to clayey
	Wolf part	--	--------	-------	Loamy	Silty to clayey
5A	Dailey-Valent loamy fine sands, 0 to 3 percent slopes	9	IVe-4	IIIs-4	Sandy	Sandy
5C	Dailey-Valent loamy fine sands, 3 to 10 percent slopes	9	VIe-4	IVe-4	Sandy	Very sandy
6C	Dix-Alice complex, 0 to 10 percent slopes	10	VIs-6	-------	--------------	---------------
	Dix part	--	--------	-------	Gravelly	Unsuitable
	Alice part	--	--------	-------	Sandy	Sandy
6E	Dix-Alice complex, 10 to 40 percent slopes	10	VIIs-6	-------	--------------	---------------
	Dix part	--	--------	-------	Gravelly	Unsuitable
	Alice part	--	--------	-------	Sandy	Sandy
7	Dune land	10	VIIIe-15	-------	--------------	---------------
8D	Dwyer-Valent-Tassel complex, 3 to 20 percent slopes	11	VIe-15	-------	--------------	---------------
	Dwyer part	--	--------	-------	Sandy	Sandy
	Valent part	--	--------	-------	Sandy	Sandy
	Tassel part	--	--------	-------	Shallow sandy	Unsuitable
9A	Embry fine sandy loam, 0 to 3 percent slopes	12	IVe-5	-------	Sandy	Sandy
9C	Embry fine sandy loam, 3 to 10 percent slopes	12	VIe-5	-------	Sandy	Sandy
10C	Epping loam, 0 to 10 percent slopes	12	VIIe-14	-------	Shallow loamy	Unsuitable
11B	Featherlegs-Wolf loams, 0 to 6 percent slopes	13	IIIe-2	-------	Loamy	Silty to clayey
11C	Featherlegs-Wolf loams, 6 to 10 percent slopes	13	IVe-2	-------	Loamy	Silty to clayey
12C	Featherlegs-Wolf-Brownrigg complex, 3 to 10 percent slopes	14	VIe-14	-------	--------------	---------------
	Featherlegs part	--	--------	-------	Loamy	Silty to clayey
	Wolf part	--	--------	-------	Loamy	Silty to clayey
	Brownrigg part	--	--------	-------	Shallow loamy	Unsuitable
13B	Hargreave-Noden sandy loams, 0 to 6 percent slopes	14	IIIe-5	IIe-5	Loamy	Sandy
13C	Hargreave-Noden sandy loams, 6 to 10 percent slopes	14	IVe-5	IIIe-5	Loamy	Sandy
14A	Jayem fine sandy loam, 0 to 3 percent slopes	15	IIIe-5	IIe-5	Sandy	Sandy
14C	Jayem fine sandy loam, 3 to 10 percent slopes	15	IVe-5	IIIe-5	Sandy	Sandy
15C	Jayem-Ascalon-Manter complex, 3 to 10 percent slopes	15	IVe-5	-------	Sandy	Sandy
16D	Jayem-Trelona-Manter complex, 3 to 20 percent slopes	15	VIe-5	-------	--------------	--------------
	Jayem part	--	--------	-------	Sandy	Sandy
	Trelona part	--	--------	-------	Shallow sandy	Unsuitable
	Manter part	--	--------	-------	Sandy	Sandy
17B	Keota loam, 0 to 6 percent slopes	16	IVe-3	-------	Loamy	Silty to clayey
18C	Keota-Epping loams, 6 to 10 percent slopes	17	VIe-14	-------	--------------	--------------
	Keota part	--	--------	-------	Loamy	Silty to clayey
	Epping part	--	--------	-------	Shallow loamy	Unsuitable
19B	Mitchell loam, 0 to 6 percent slopes	18	IVe-3	-------	Loamy	Silty to clayey

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability unit		Range site	Windbreak site
			Dryland	Irrigated		
			Symbol	Symbol	Name	Name
19C	Mitchell loam, 6 to 10 percent slopes	18	IVe-3	-------	Loamy	Silty to clayey
19D	Mitchell loam, 10 to 20 percent slopes	18	VIe-3	-------	Loamy	Silty to clayey
20F	Motoqua-Rock outcrop complex, 20 to 60 percent slopes	19	VIIe-14	-------	---------------	---------------
	Motoqua part	--	-------	-------	Shallow igneous	Unsuitable
	Rock outcrop part	--	-------	-------	---------------	---------------
21B	Otero fine sandy loam, 0 to 6 percent slopes	21	IVe-5	-------	Sandy	Sandy
21C	Otero fine sandy loam, 6 to 10 percent slopes	21	VIe-5	-------	Sandy	Sandy
22	Rock outcrop-Tassel complex	21	VIIe-14	-------	---------------	---------------
	Rock outcrop part	--	-------	-------	---------------	---------------
	Tassel part	--	-------	-------	Shallow sandy	Unsuitable
23B	Rosebud-Hargreave fine sandy loams, 0 to 6 percent slopes	22	IIIe-5	IIe-5	Loamy	Sandy
23C	Rosebud-Hargreave fine sandy loams, 6 to 10 percent slopes	22	IVe-5	-------	Loamy	Sandy
24B	Rosebud-Trelona fine sandy loams, 0 to 6 percent slopes	22	IVe-5	IIIe-5	---------------	---------------
	Rosebud part	--	-------	-------	Loamy	Sandy
	Trelona part	--	-------	-------	Shallow sandy	Unsuitable
24C	Rosebud-Trelona fine sandy loams, 6 to 10 percent slopes	22	IVe-5	IIIe-5	---------------	---------------
	Rosebud part	--	-------	-------	Loamy	Sandy
	Trelona part	--	-------	-------	Shallow sandy	Unsuitable
24D	Rosebud-Trelona fine sandy loams, 10 to 20 percent slopes	22	VIe-5	-------	---------------	---------------
	Rosebud part	--	-------	-------	Loamy	Sandy
	Trelona part	--	-------	-------	Shallow sandy	Unsuitable
25	Sandstone outcrop	23	VIIIs-83	-------	---------------	---------------
26B	Satanta-Noden complex, 0 to 6 percent slopes	23	IIIe-5	-------	Loamy	Sandy
26C	Satanta-Noden complex, 6 to 10 percent slopes	23	IVe-5	-------	Loamy	Sandy
27D	Satanta-Willowman-Lambman complex, 3 to 20 percent slopes	23	VIe-5	-------	---------------	---------------
	Satanta part	--	-------	-------	Loamy	Sandy
	Willowman part	--	-------	-------	Coarse upland	Sandy
	Lambman part	--	-------	-------	Shallow loamy	Unsuitable
28	Torrifluvents-Fluvaquents complex	25	IVw-63	IIIw-63	Subirrigated	Moderately wet
29	Torrifluvents-Fluvaquents complex, saline	25	VIws-10	VIws-10	Saline subirrigated	Unsuitable
30	Torriorthents, gullied	25	VIIe-82	-------	Sandy	Sandy
31	Ustic Torrifluvents, undulating	26	VIIs-6	-------	Sandy lowland	Sandy
32D	Valent-Dwyer fine sands, rolling	26	VIe-15	-------	Sands	Very sandy
32E	Valent-Dwyer fine sands, hilly	26	VIIe-15	-------	Choppy sands	Very sandy
33A	Valent-Dwyer loamy fine sands, 0 to 3 percent slopes	26	IVe-4	IIIe-4	Sandy	Very sandy
33C	Valent-Dwyer loamy fine sands, 3 to 10 percent slopes	26	VIe-4	IVe-4	Sandy	Very sandy
34B	Vetal fine sandy loam, 0 to 6 percent slopes	27	IIIe-5	IIe-5	Sandy	Sandy
34C	Vetal fine sandy loam, 6 to 10 percent slopes	27	IVe-5	IIIe-5	Sandy	Sandy
35F	Wendover-Rock outcrop complex, 10 to 60 percent slopes	28	VIIe-14	-------	---------------	---------------
	Wendover part	--	-------	-------	Shallow loamy	Unsuitable
	Rock outcrop part	--	-------	-------	---------------	---------------

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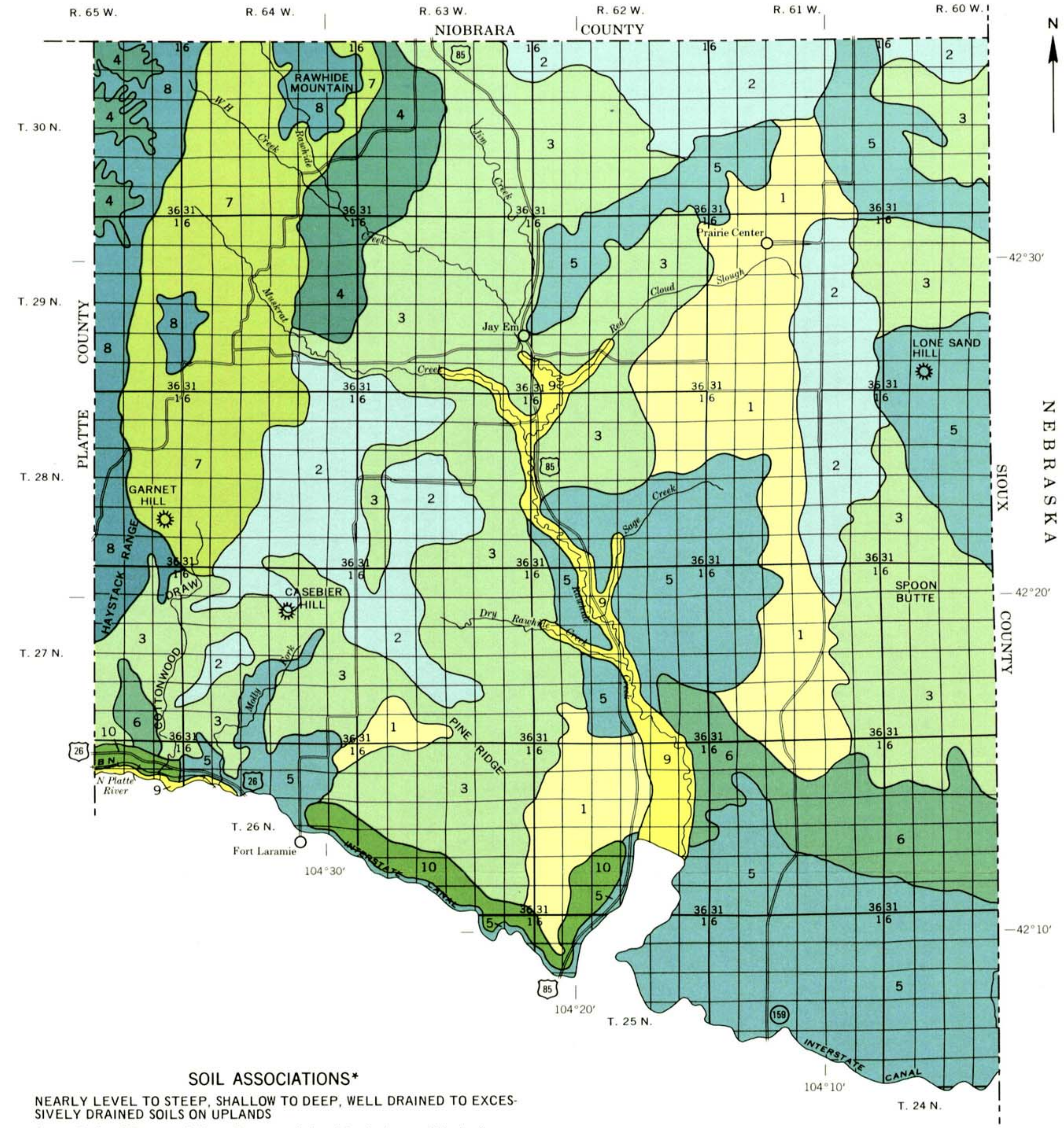


SOIL ASSOCIATIONS*

NEARLY LEVEL TO STEEP, SHALLOW TO DEEP, WELL DRAINED TO EXCESSIVELY DRAINED SOILS ON UPLANDS

1	Jayem-Manter-Alice association: Deep, nearly level to sloping, well drained loamy soils that formed in eolian deposits and in material weathered from sandstone
2	Satanta-Noden-Rosebud association: Deep and moderately deep, nearly level to sloping, well drained loamy soils that formed in eolian deposits and in material weathered from sandstone
3	Jayem-Manter-Trelona association: Deep and shallow, nearly level to moderately steep, well drained loamy soils that formed in eolian deposits and in material weathered from sandstone
4	Satanta-Rosebud-Lambman association: Deep to shallow, nearly level to moderately steep, well drained loamy soils that formed in eolian deposits and in material weathered from sandstone
5	Valent-Dwyer association: Deep, nearly level to steep, excessively drained sandy soils that formed in eolian deposits
6	Mitchell-Bordeaux-Epping association: Deep and shallow, nearly level to moderately steep, well drained loamy soils that formed mainly in sediment that was derived from siltstone
7	Featherlegs-Wolf association: Deep, nearly level to hilly, well drained loamy soils that formed in alluvial and colluvial sediment
8	Wendover-Motoqua-Rock outcrop association: Shallow, moderately steep and steep, well drained loamy soils that formed in material weathered from granite, limestone and sandstone, and outcrops of granite, limestone and sandstone

NEARLY LEVEL TO STEEP, DEEP, EXCESSIVELY DRAINED TO POORLY DRAINED SOILS ON FLOOD PLAINS, FANS, TERRACES, TABLELANDS, AND UPLANDS

9	Torrifluvents-Fluvaquents-Torriorthents association: Nearly level to sloping, well drained to poorly drained, loamy and sandy soils that formed in alluvial deposits on flood plains and uplands
10	Dix-Alice association: Nearly level to steep, well drained and excessively drained, gravelly and nongravelly loamy soils that formed in alluvial deposits on fans, terraces, and tablelands

* Texture refers to the surface layer of the major soils.

Compiled 1977

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
WYOMING AGRICULTURAL EXPERIMENT STATION

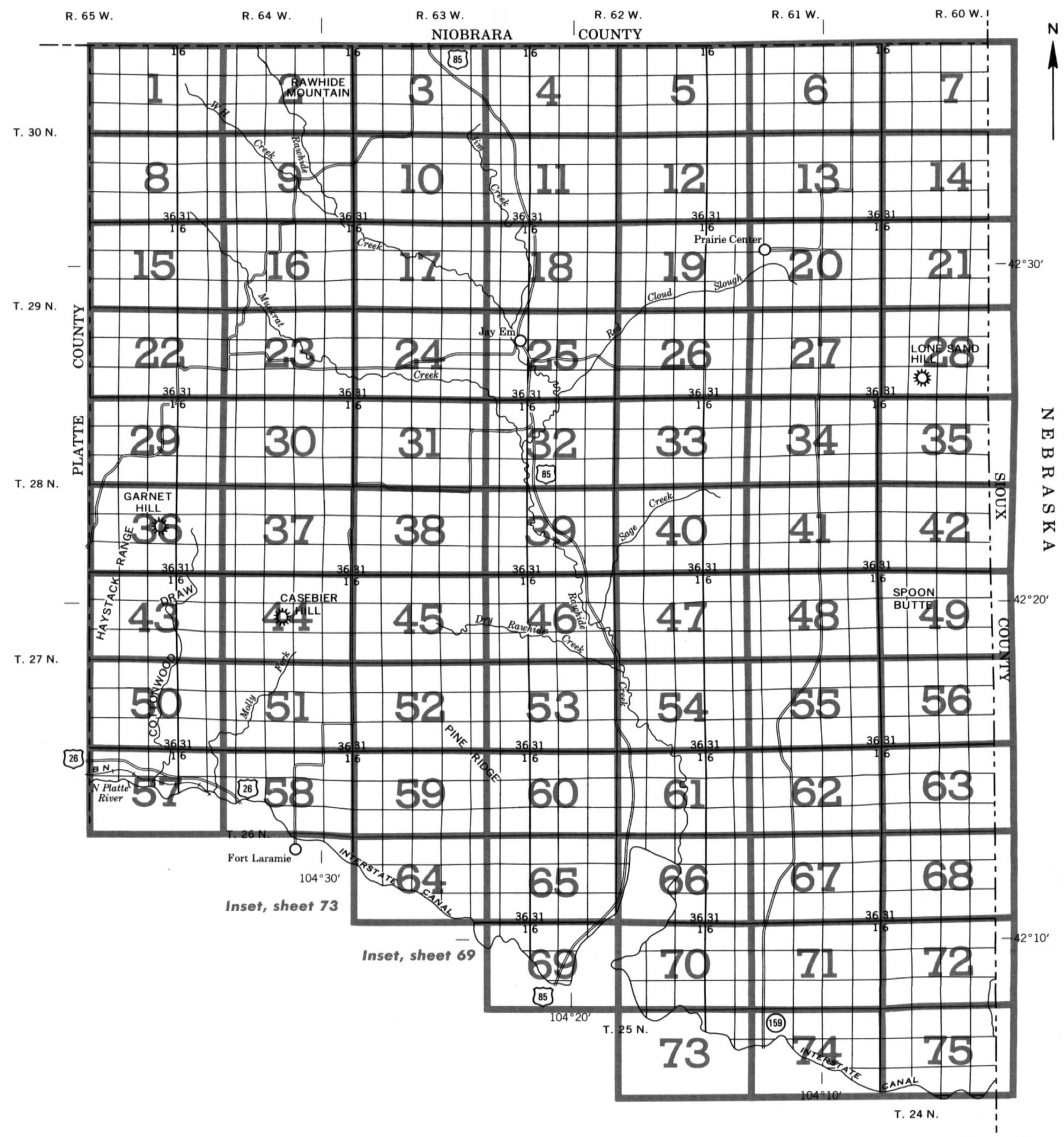
GENERAL SOIL MAP
GOSHEN COUNTY, WYOMING
NORTHERN PART

Scale 1:253,440
1 0 1 2 3 4 Miles

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36



INDEX TO MAP SHEETS
GOSHEN COUNTY, WYOMING
NORTHERN PART

Scale 1:253,440

1 0 1 2 3 4 Miles

SECTIONALIZED TOWNSHIP

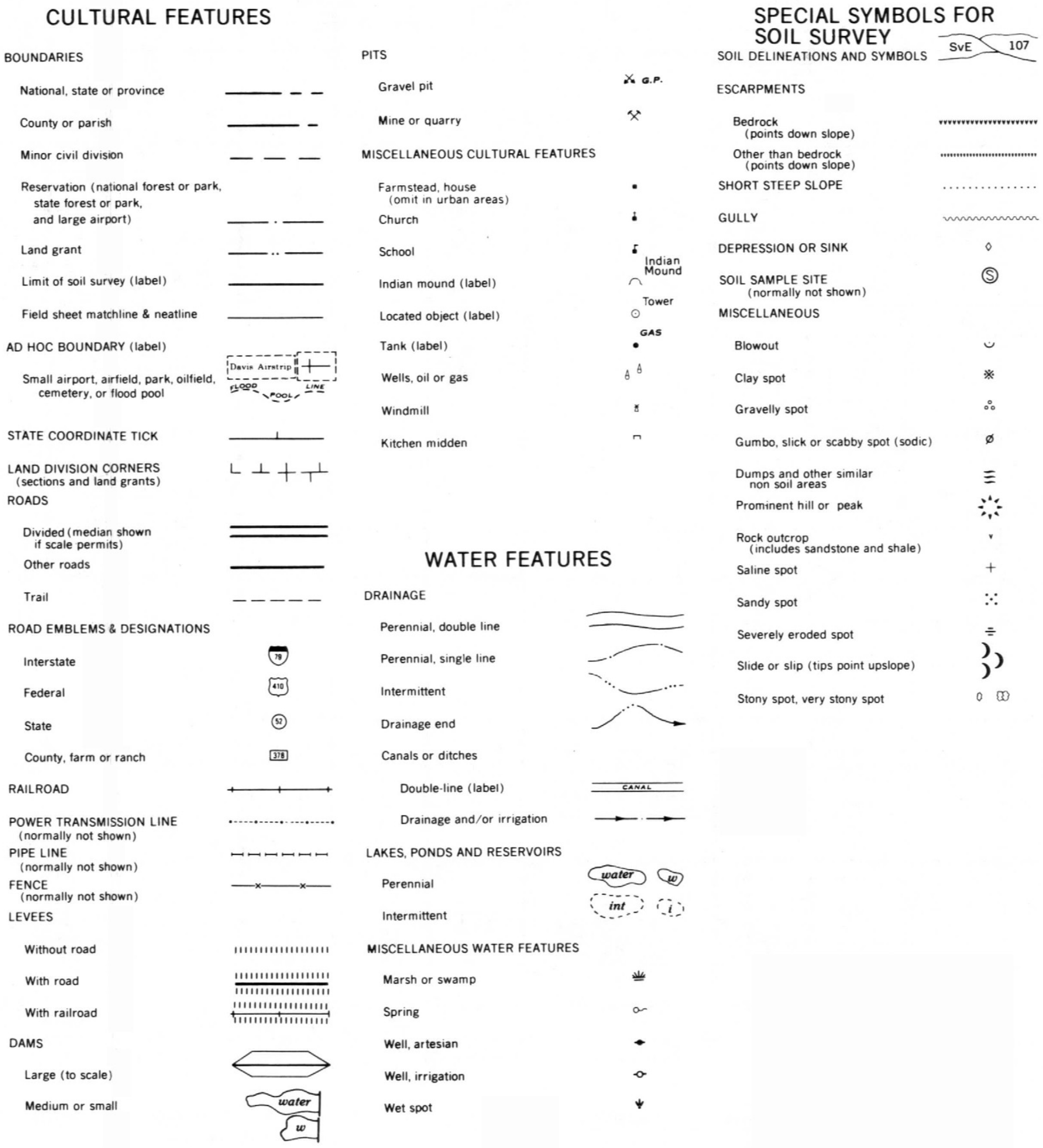
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

SOIL LEGEND

Arabic numerals in symbol indicate map unit. The capital letter following the numeral or numerals indicates slope class; i.e., A, B, C, D, E, or F. Symbols without slope class letters are for miscellaneous land areas or broadly defined units with a fair to considerable range in slope. Symbols for broadly defined units are underlined, i.e., 7.

SYMBOL	NAME
1B	Albinas loam, 0 to 6 percent slopes
2B	Alice fine sandy loam, 0 to 6 percent slopes
2C	Alice fine sandy loam, 6 to 10 percent slopes
3A	Bordeaux fine sandy loam, 0 to 3 percent slopes
3C	Bordeaux fine sandy loam, 3 to 10 percent slopes
4E	Brownrigg-Featherlegs-Wolf complex, 10 to 40 percent slopes
5A	Dailey-Valent loamy fine sands, 0 to 3 percent slopes
5C	Dailey-Valent loamy fine sands, 3 to 10 percent slopes
6C	Dix-Alice complex, 0 to 10 percent slopes
6E	Dix-Alice complex, 10 to 40 percent slopes
7	Dune land
8D	Dwyer-Valent-Tassel complex, 3 to 20 percent slopes
9A	Embry fine sandy loam, 0 to 3 percent slopes
9C	Embry fine sandy loam, 3 to 10 percent slopes
10C	Epping loam, 0 to 10 percent slopes
11B	Featherlegs-Wolf loams, 0 to 6 percent slopes
11C	Featherlegs-Wolf loams, 6 to 10 percent slopes
12C	Featherlegs-Wolf-Brownrigg complex, 3 to 10 percent slopes
13B	Hargreave-Noden sandy loams, 0 to 6 percent slopes
13C	Hargreave-Noden sandy loams, 6 to 10 percent slopes
14A	Jayem fine sandy loam, 0 to 3 percent slopes
14C	Jayem fine sandy loam, 3 to 10 percent slopes
15C	Jayem-Ascalon-Manter complex, 3 to 10 percent slopes
16D	Jayem-Trelona-Manter complex, 3 to 20 percent slopes
17B	Keota loam, 0 to 6 percent slopes
18C	Keota-Epping loams, 6 to 10 percent slopes
19B	Mitchell loam, 0 to 6 percent slopes
19C	Mitchell loam, 6 to 10 percent slopes
19D	Mitchell loam, 10 to 20 percent slopes
20F	Motoqua-Rock outcrop complex, 20 to 60 percent slopes
21B	Otero fine sandy loam, 0 to 6 percent slopes
21C	Otero fine sandy loam, 6 to 10 percent slopes
22	Rock outcrop-Tassel complex
23B	Rosebud-Hargreave fine sandy loams, 0 to 6 percent slopes
23C	Rosebud-Hargreave fine sandy loams, 6 to 10 percent slopes
24B	Rosebud-Trelona fine sandy loams, 0 to 6 percent slopes
24C	Rosebud-Trelona fine sandy loams, 6 to 10 percent slopes
24D	Rosebud-Trelona fine sandy loams, 10 to 20 percent slopes
25	Sandstone outcrop
26B	Santanta-Noden complex, 0 to 6 percent slopes
26C	Santanta-Noden complex, 6 to 10 percent slopes
27D	Santanta-Willowman-Lambman complex, 3 to 20 percent slopes
28	Torrifluvents-Fluvaquents complex
29	Torrifluvents-Fluvaquents complex, saline
30	Torriorthents, gullied
31	Ustic Torrifluvents, undulating
32D	Valent-Dwyer fine sands, rolling
32E	Valent-Dwyer fine sands, hilly
33A	Valent-Dwyer loamy fine sands, 0 to 3 percent slopes
33C	Valent-Dwyer loamy fine sands, 3 to 10 percent slopes
34B	Vetal fine sandy loam, 0 to 6 percent slopes
34C	Vetal fine sandy loam, 6 to 10 percent slopes
35F	Wendover-Rock outcrop complex, 10 to 60 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND



CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline & neatline

AD HOC BOUNDARY (label)

- Small airport, airfield, park, oilfield, cemetery, or flood pool — Davis Airstrip; FLOOD POOL LINE

STATE COORDINATE TICK

LAND DIVISION CORNERS (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEMS & DESIGNATIONS

- Interstate — 79
- Federal — 410
- State — 52
- County, farm or ranch — 378

RAILROAD

POWER TRANSMISSION LINE (normally not shown)

PIPE LINE (normally not shown)

FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or small — water; w

PITS

- Gravel pit — G.P.
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) — Indian Mound
- Located object (label) — Tower
- Tank (label) — GAS
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) — CANAL
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial — water; w
- Intermittent — int; i

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS — SvE; 107

ESCARPMENTS

- Bedrock (points down slope)
- Other than bedrock (points down slope)

SHORT STEEP SLOPE

GULLY

DEPRESSION OR SINK

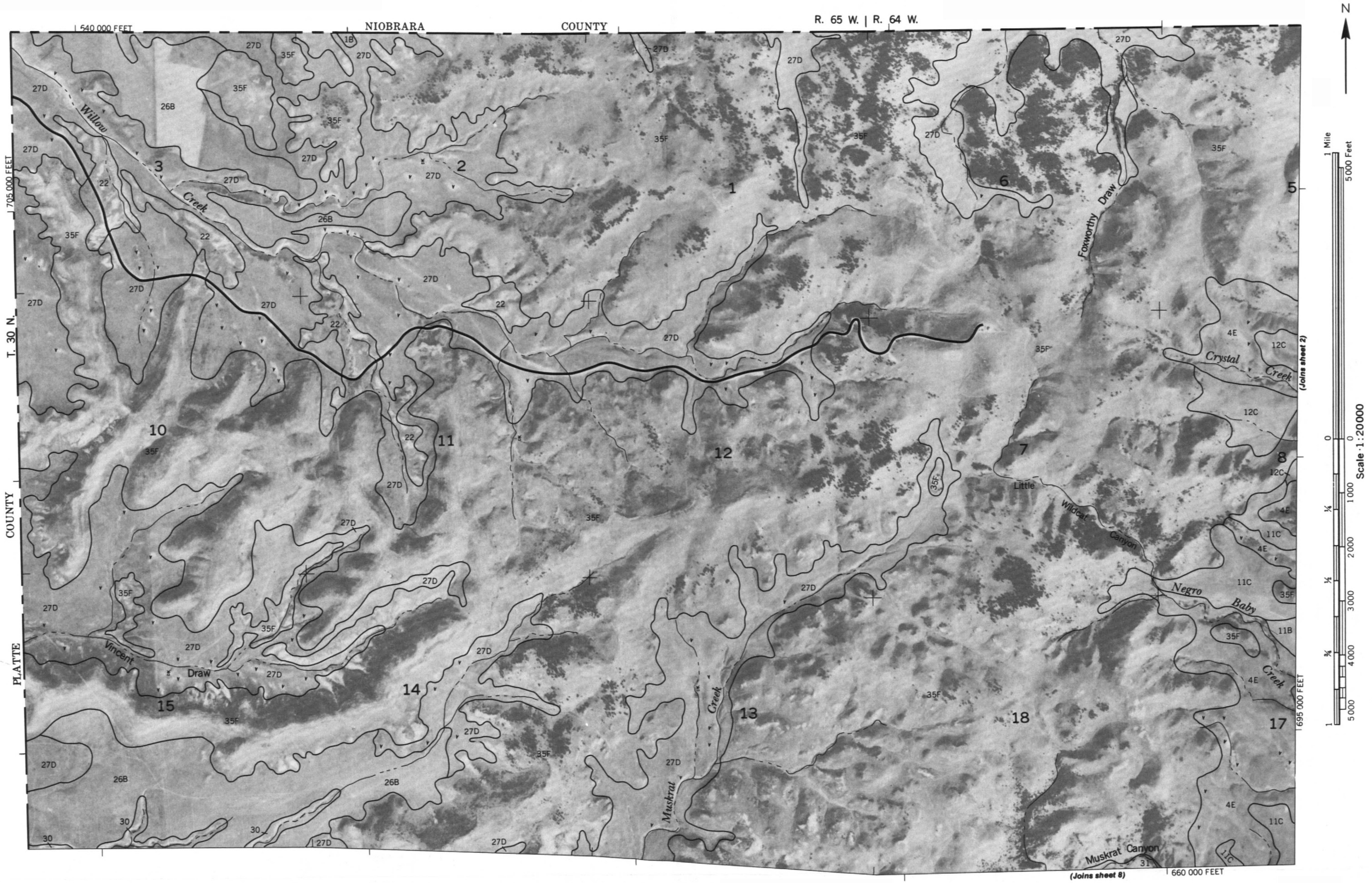
SOIL SAMPLE SITE (normally not shown) — S

MISCELLANEOUS

- Blowout
- Clay spot
- Gravelly spot
- Gumbo, slick or scabby spot (sodic)
- Dumps and other similar non soil areas
- Prominent hill or peak
- Rock outcrop (includes sandstone and shale)
- Saline spot
- Sandy spot
- Severely eroded spot
- Slide or slip (tips point upslope)
- Stony spot, very stony spot

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 1

①

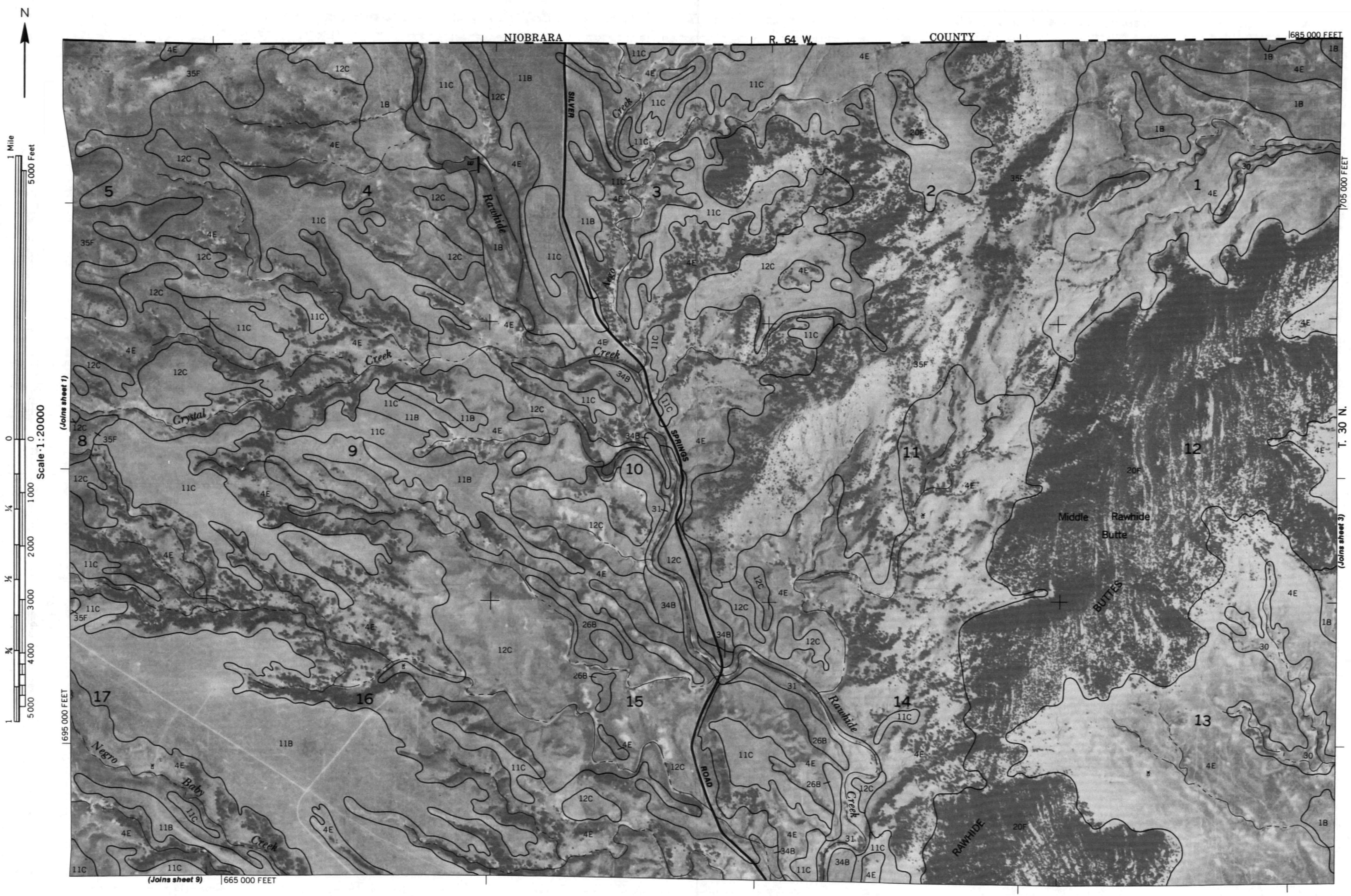


GOSHEN COUNTY, WYOMING, NORTH PART NO. 1

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

②

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 2

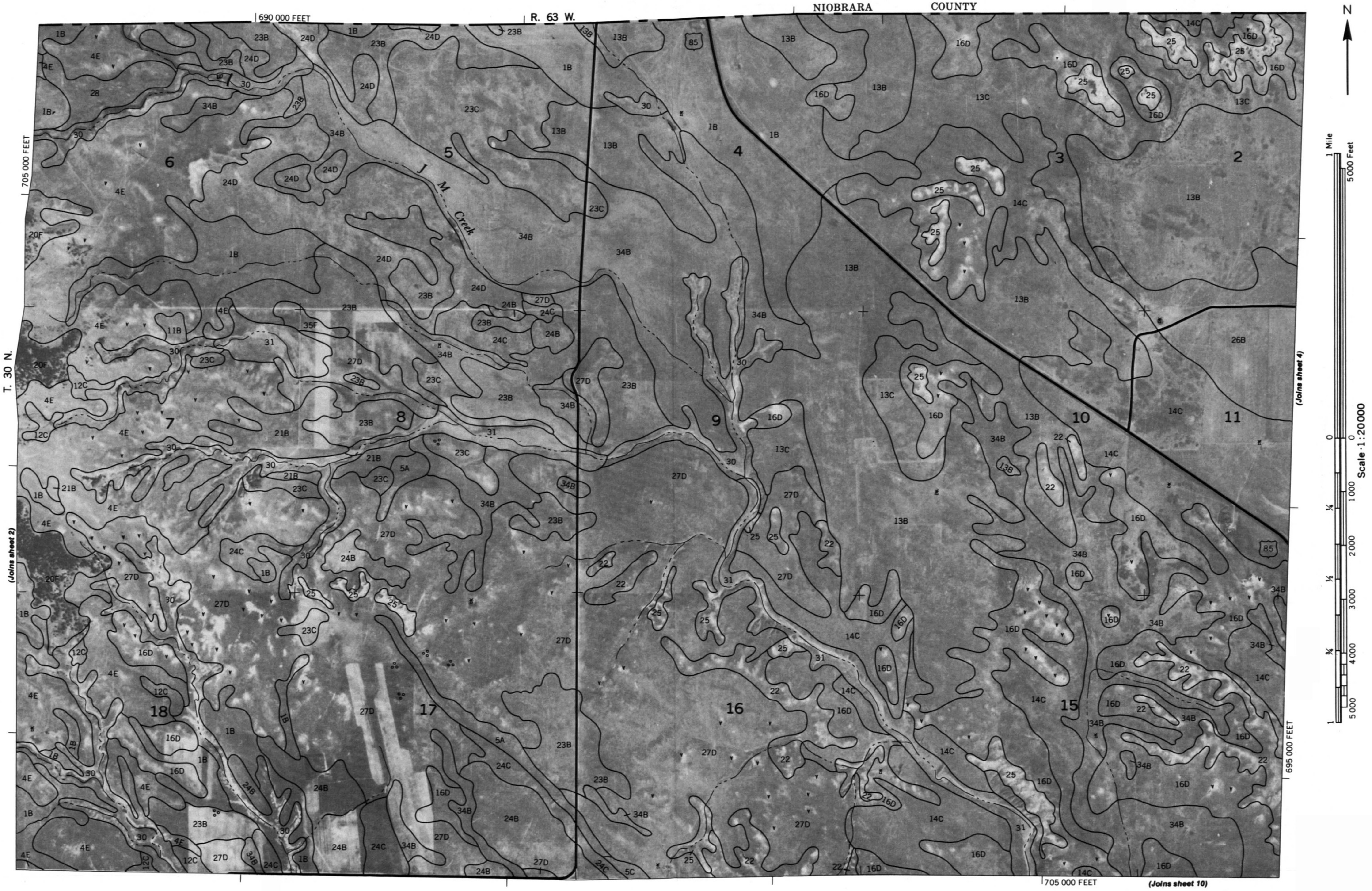


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 2

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 3

③



GOSHEN COUNTY, WYOMING, NORTH PART NO. 3

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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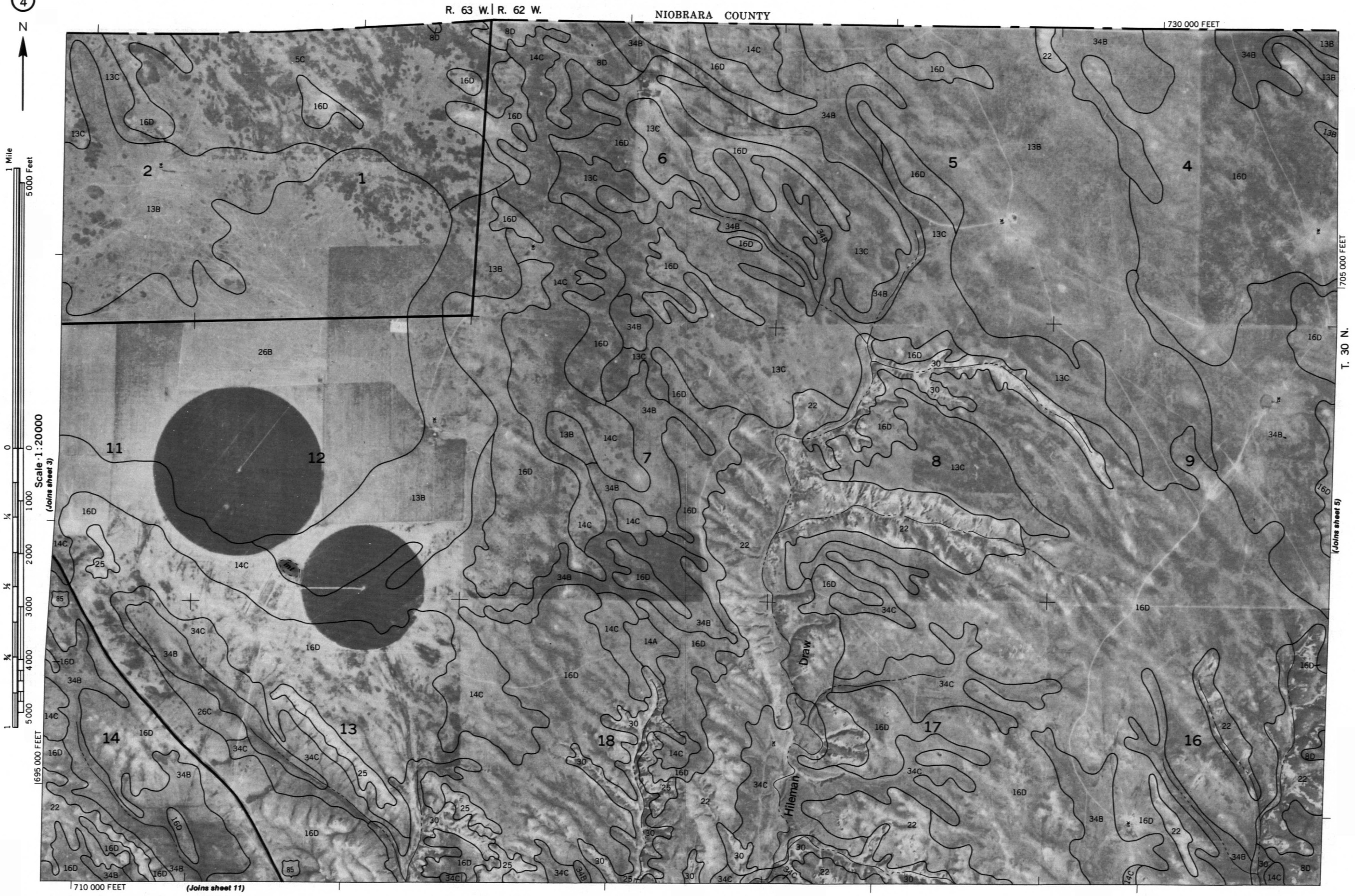
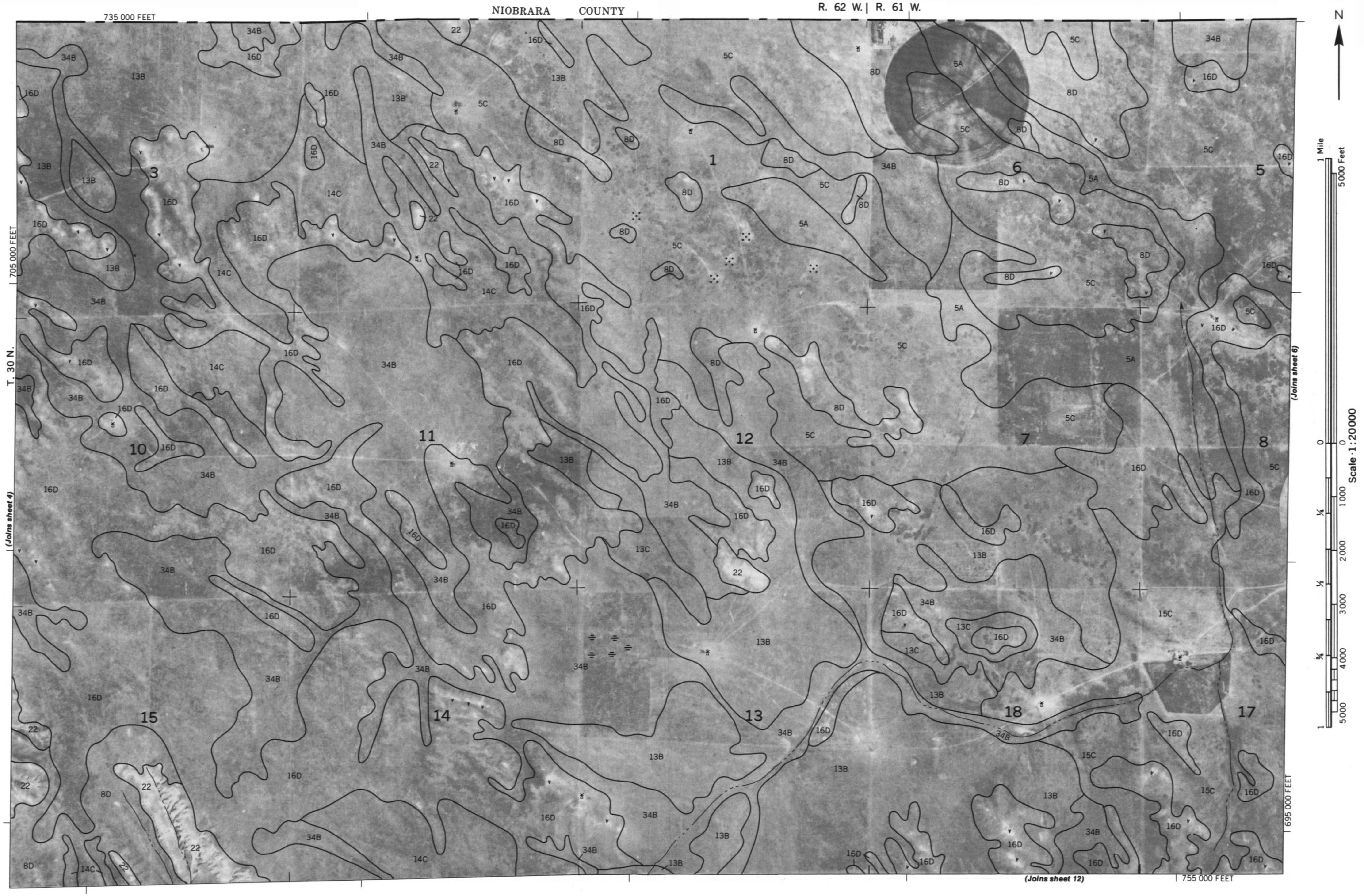
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 4



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 4

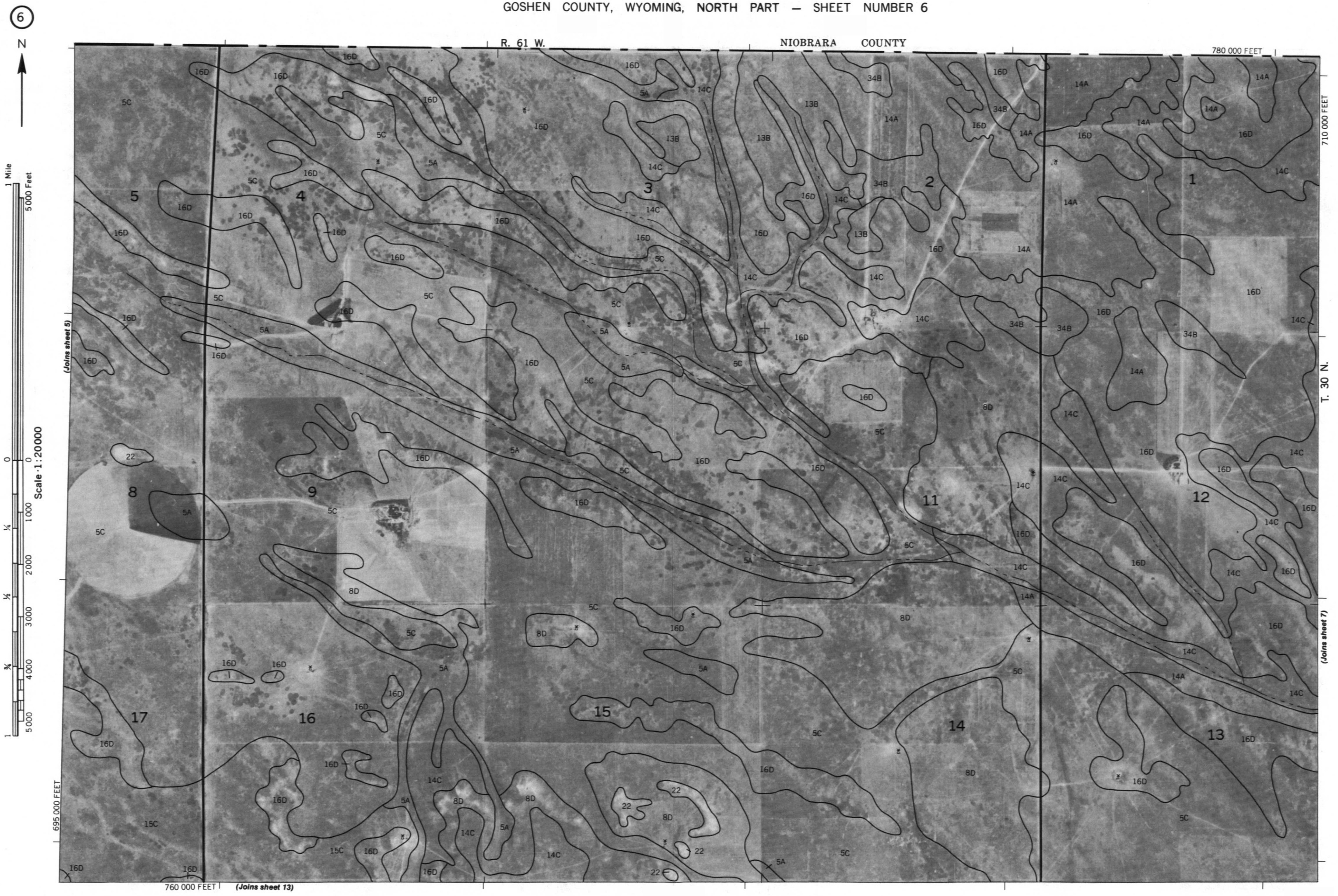
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 5



GOSHEN COUNTY, WYOMING, NORTH PART NO. 5

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

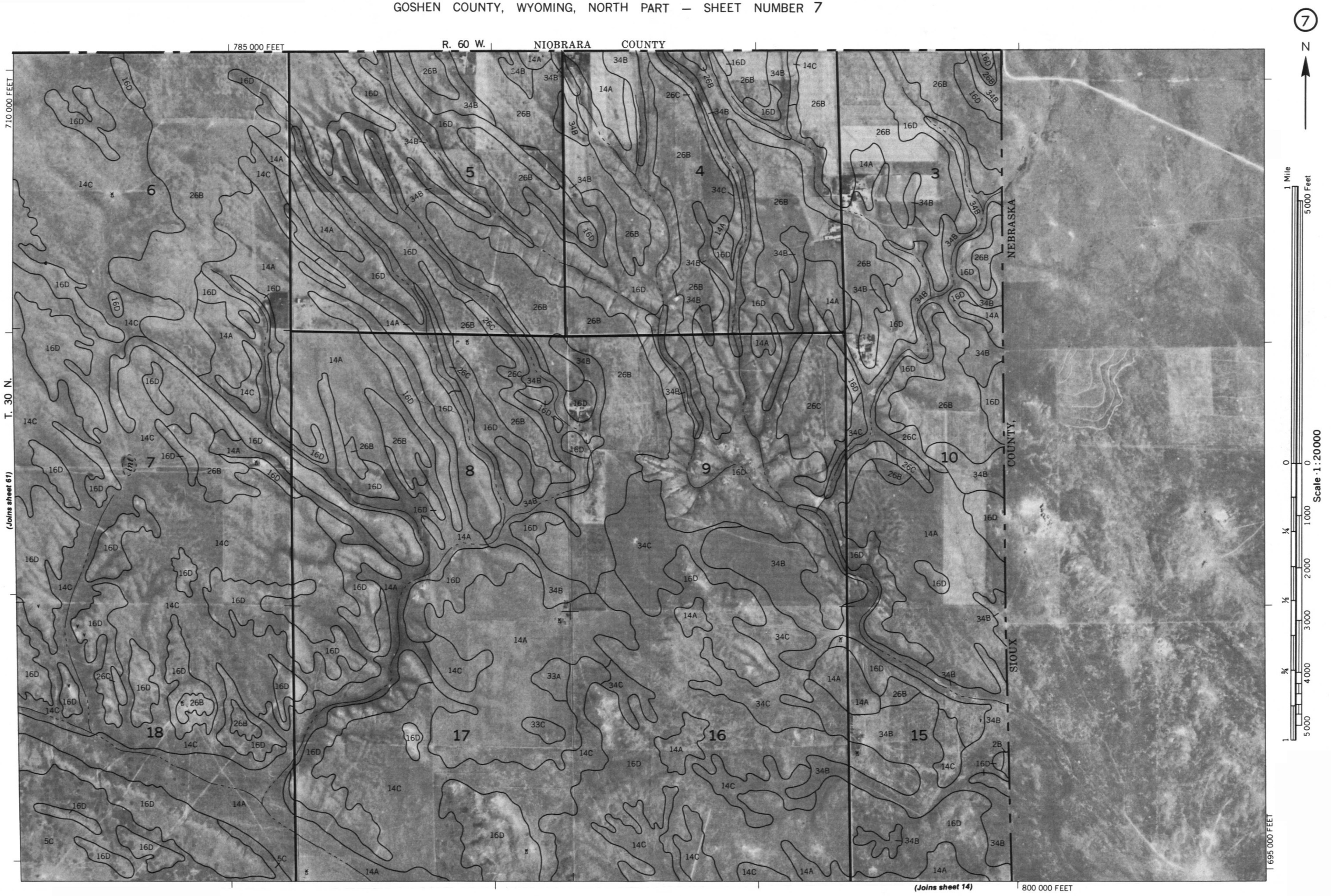
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 6



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 6

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 7



GOSHEN COUNTY, WYOMING, NORTH PART NO. 7

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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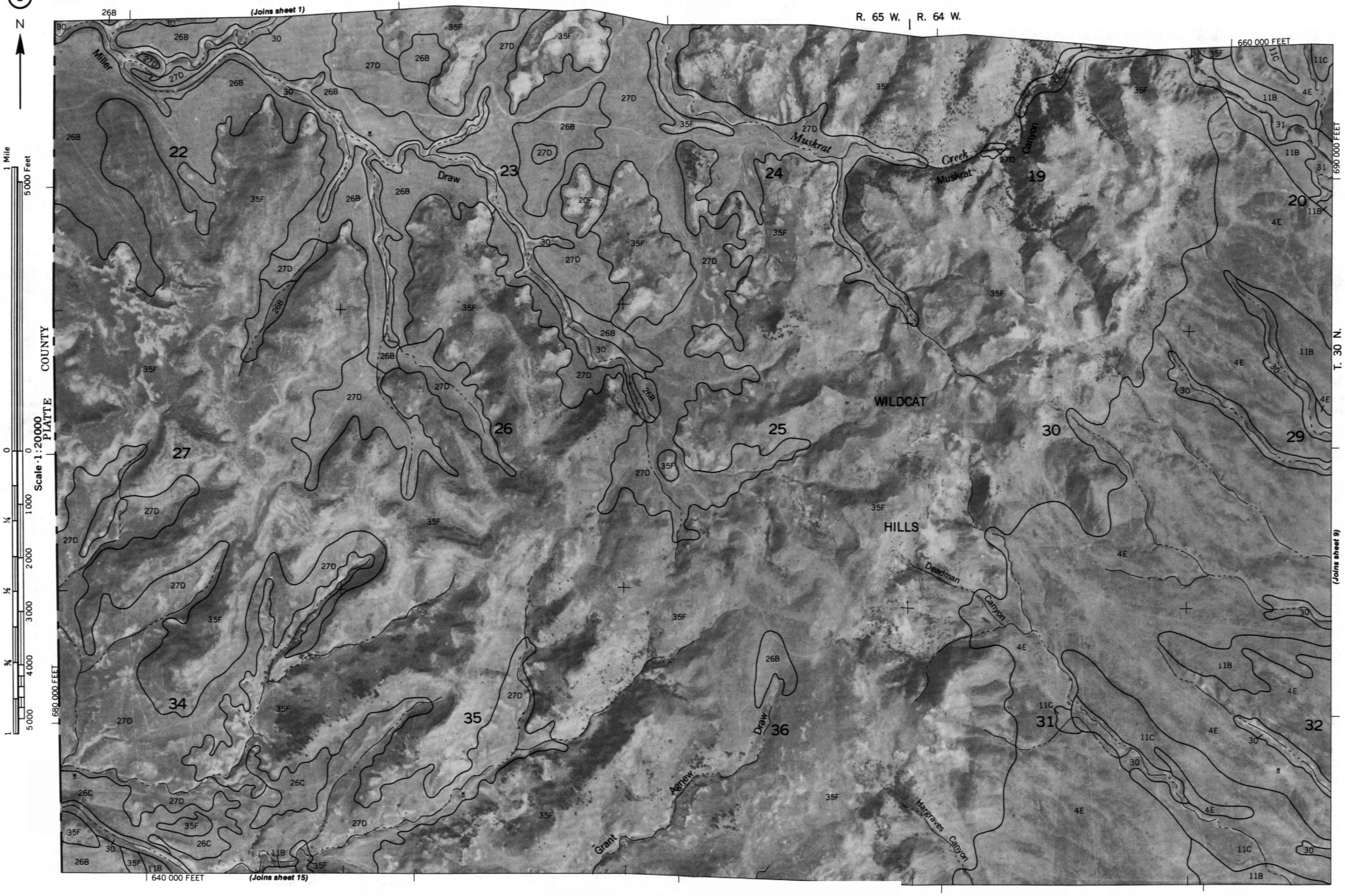
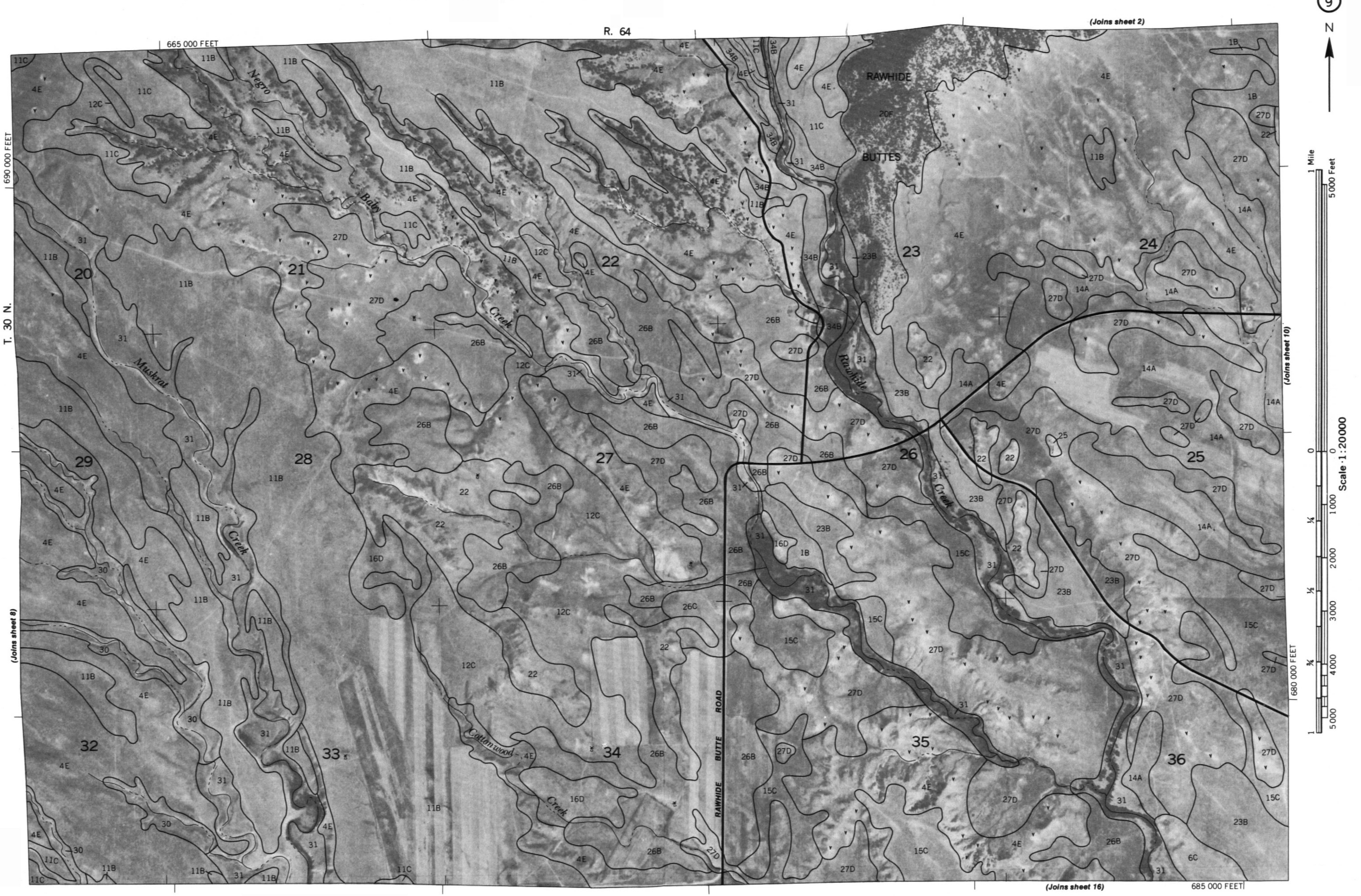
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 8



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 8

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 9



GOSHEN COUNTY, WYOMING, NORTH PART NO. 9

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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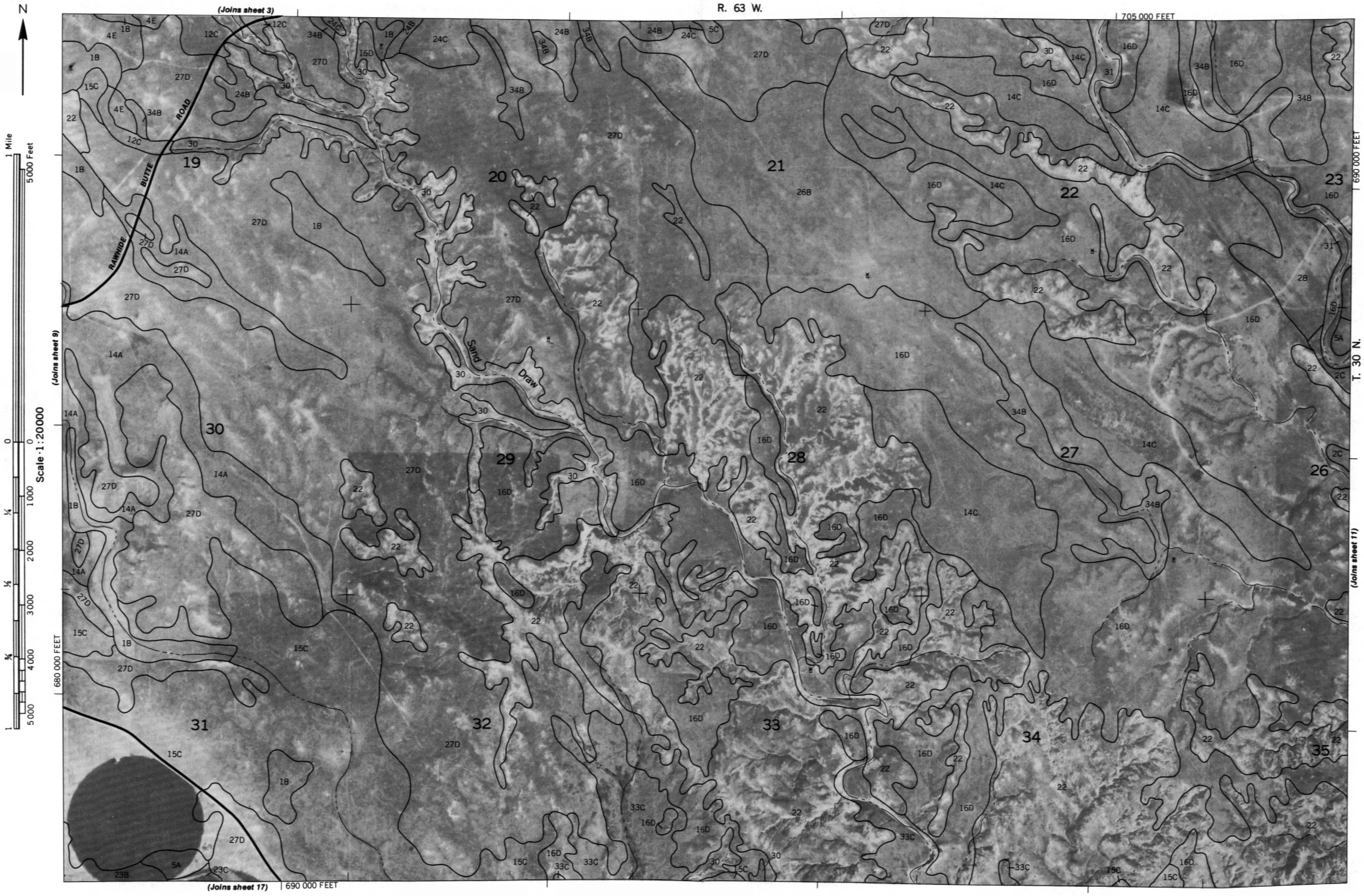
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 10



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 10

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 11

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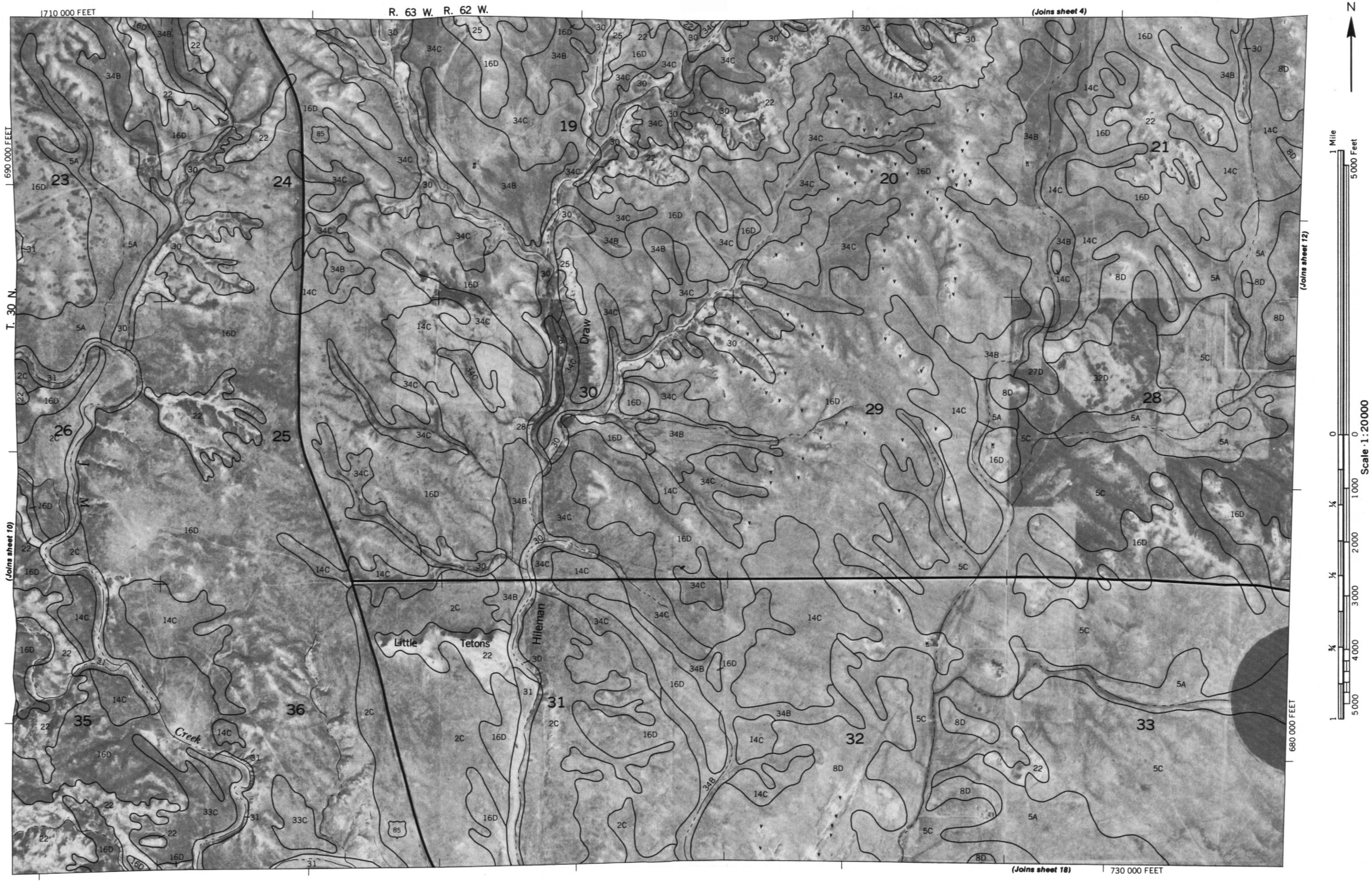
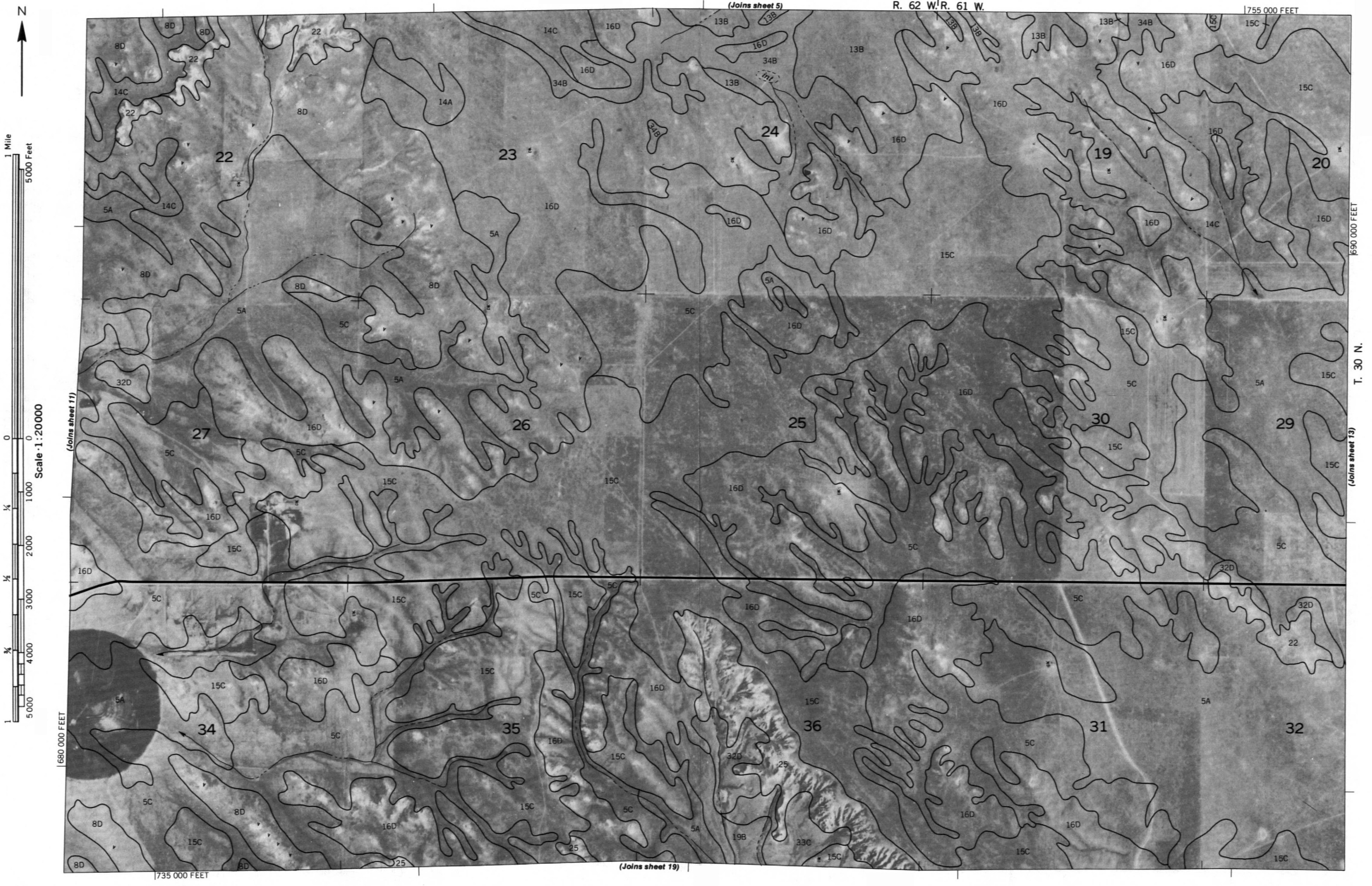


GOSHEN COUNTY, WYOMING, NORTH PART NO. 11

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 12

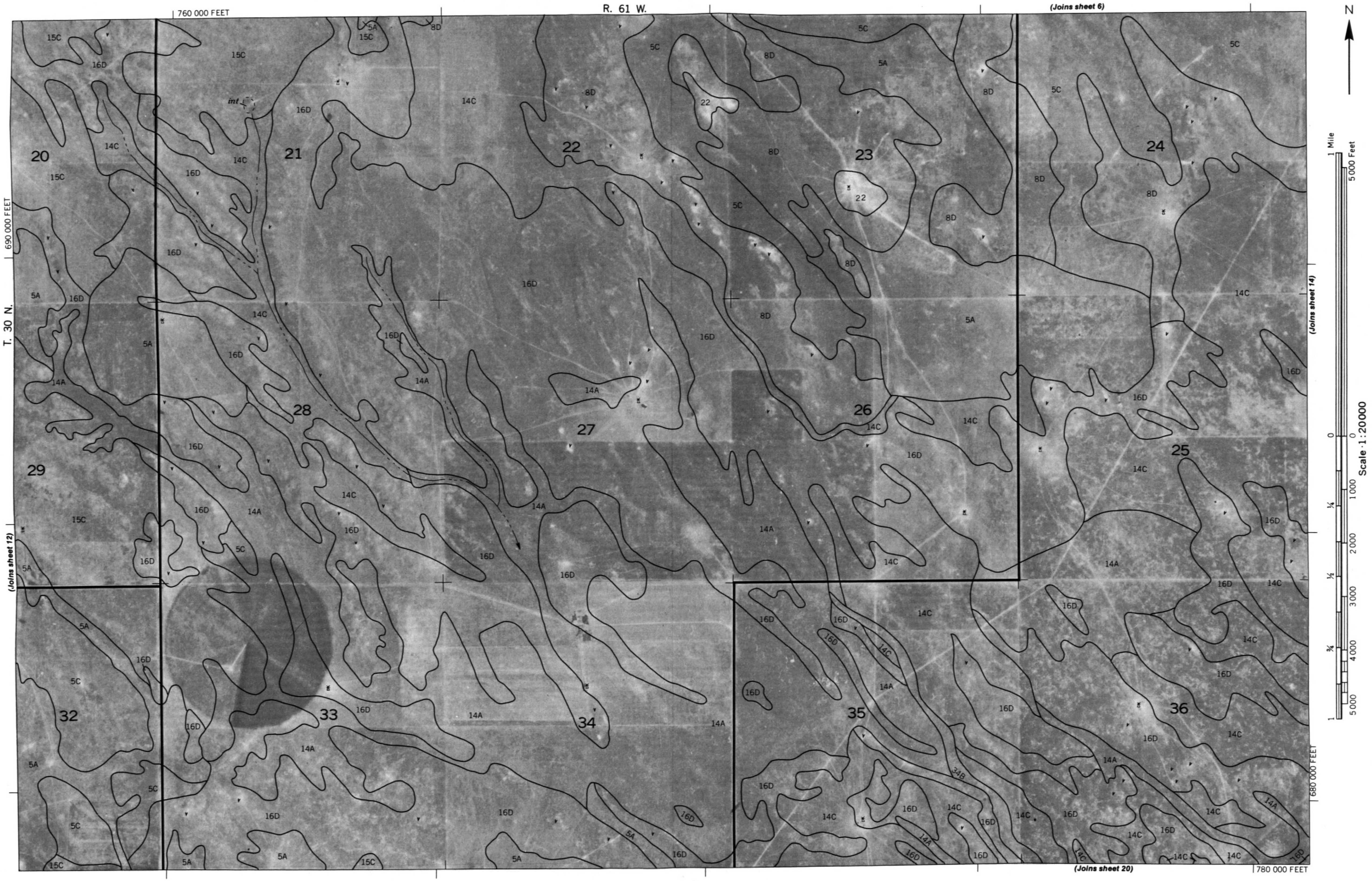


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 12

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 13

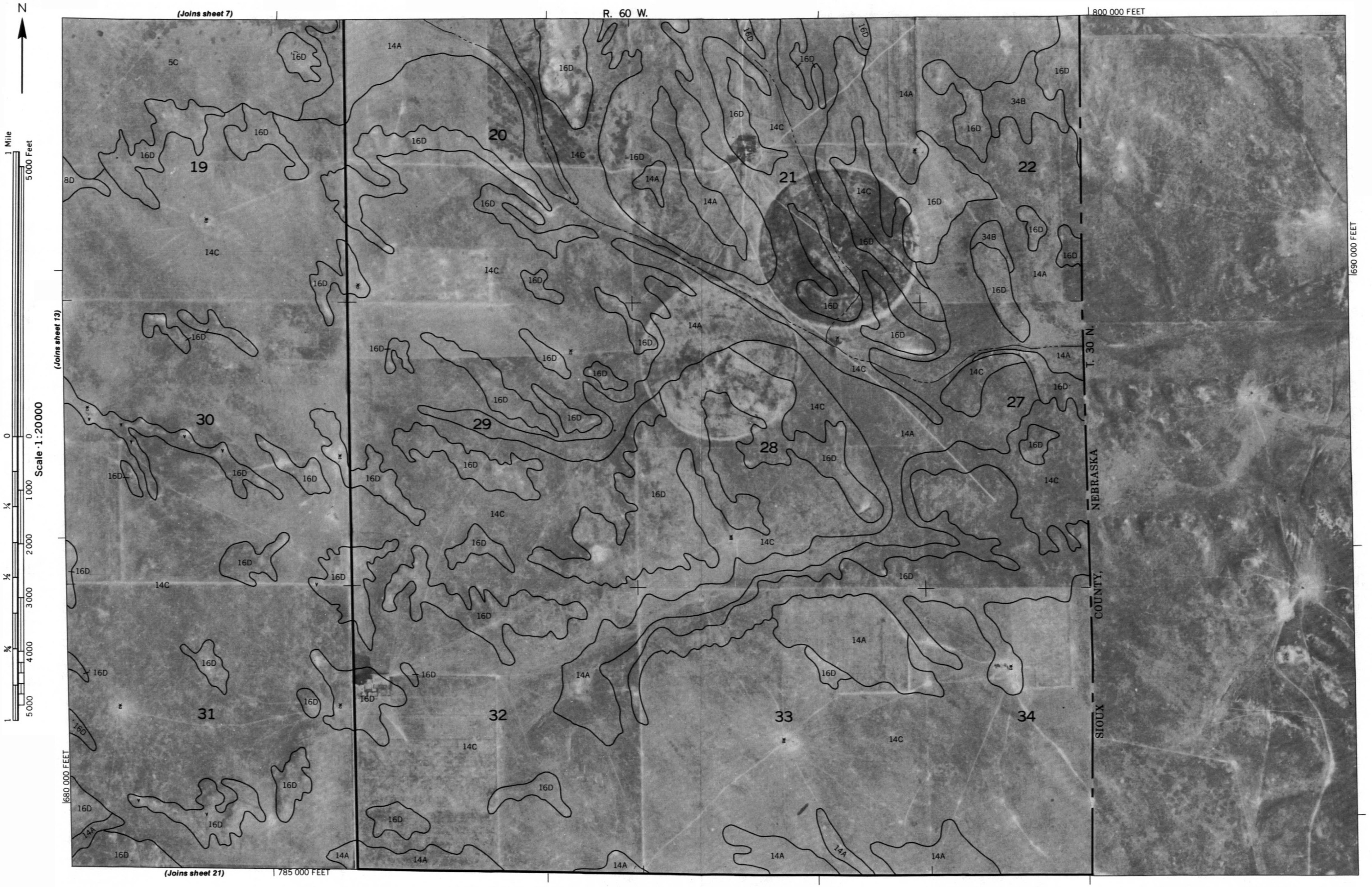
⑬



GOSHEN COUNTY, WYOMING, NORTH PART NO. 13

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

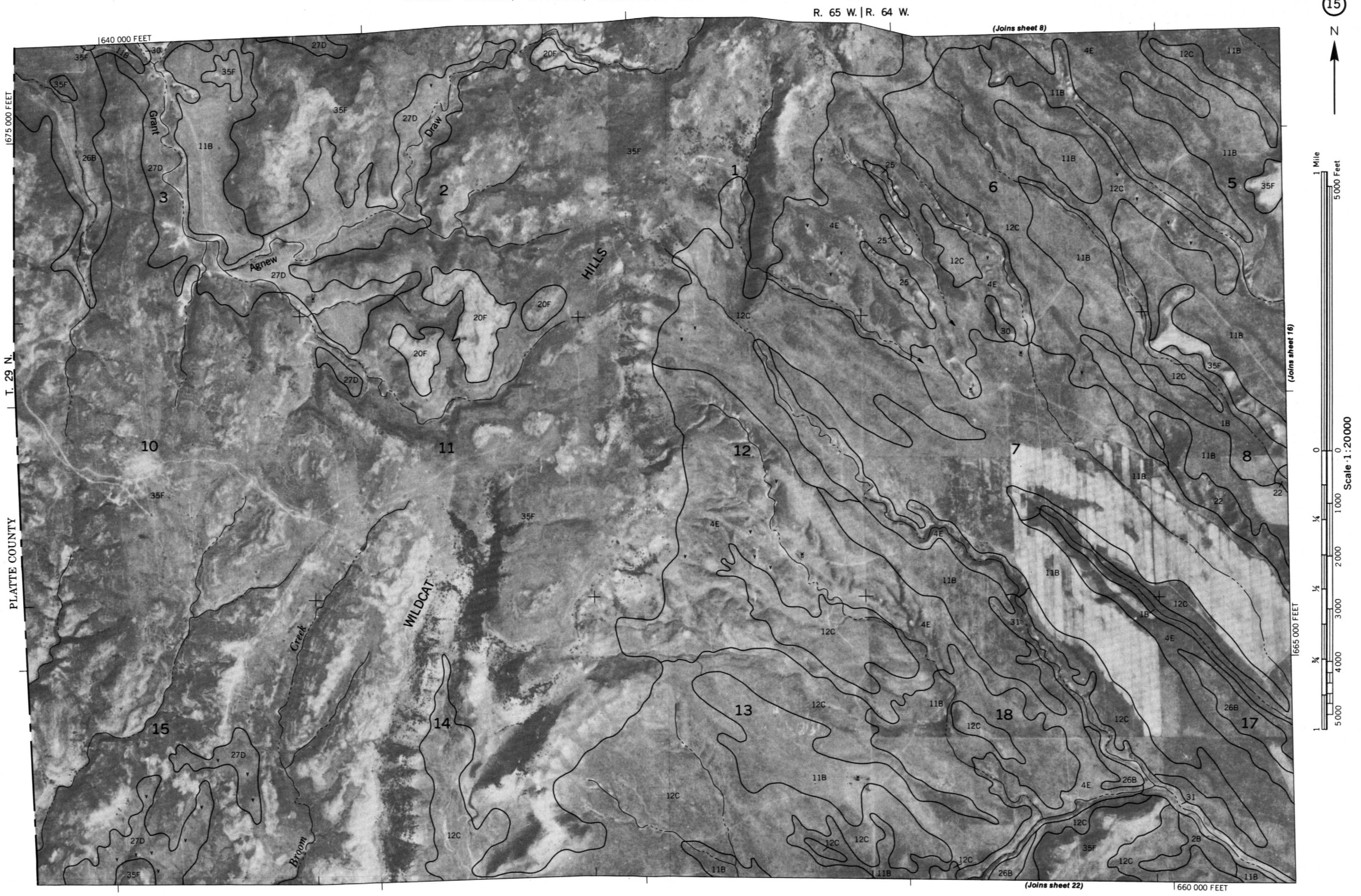
GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 14



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 14

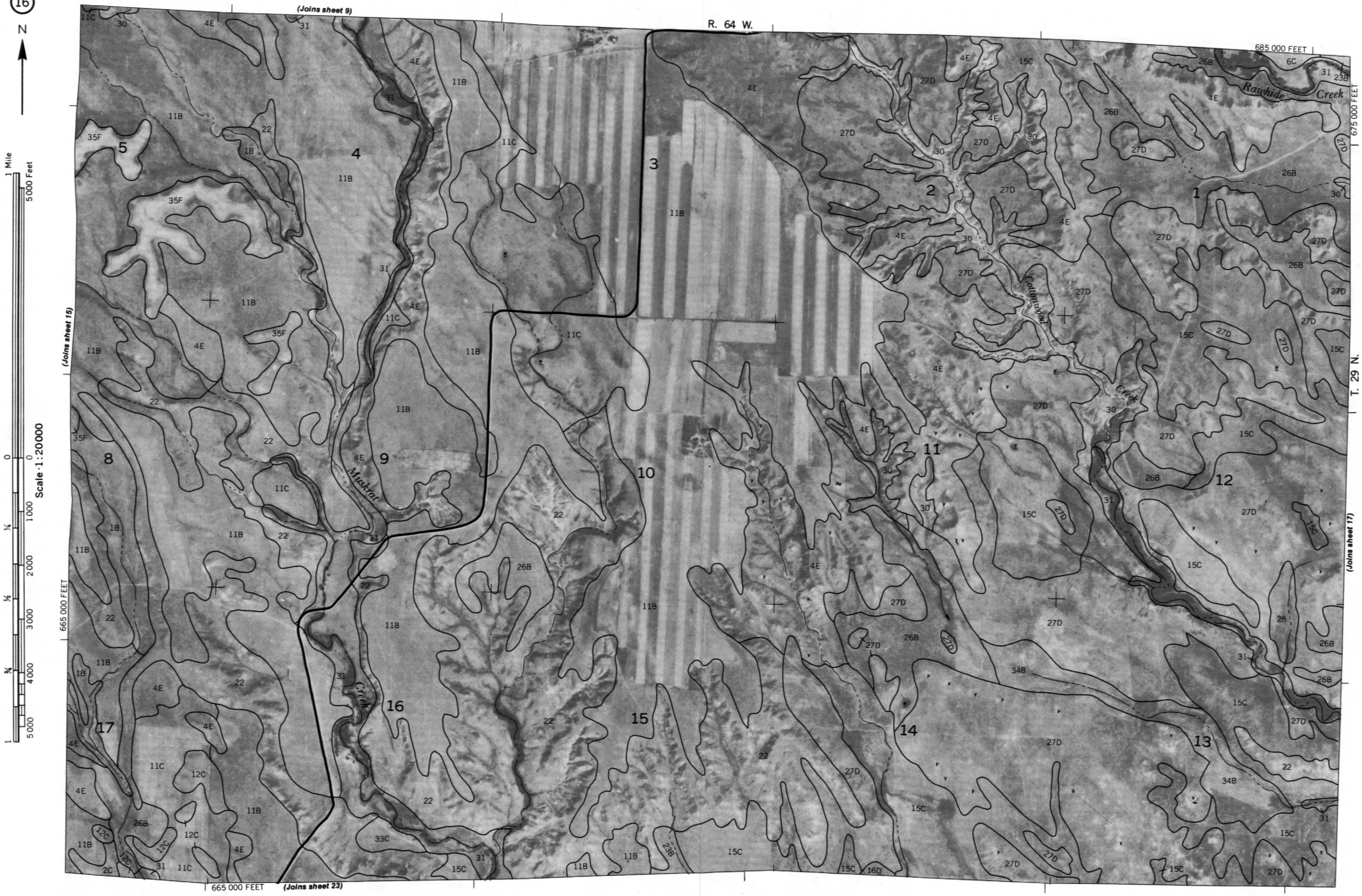
GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 15



GOSHEN COUNTY, WYOMING, NORTH PART NO. 15

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating ager
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 16



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 16

GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 17

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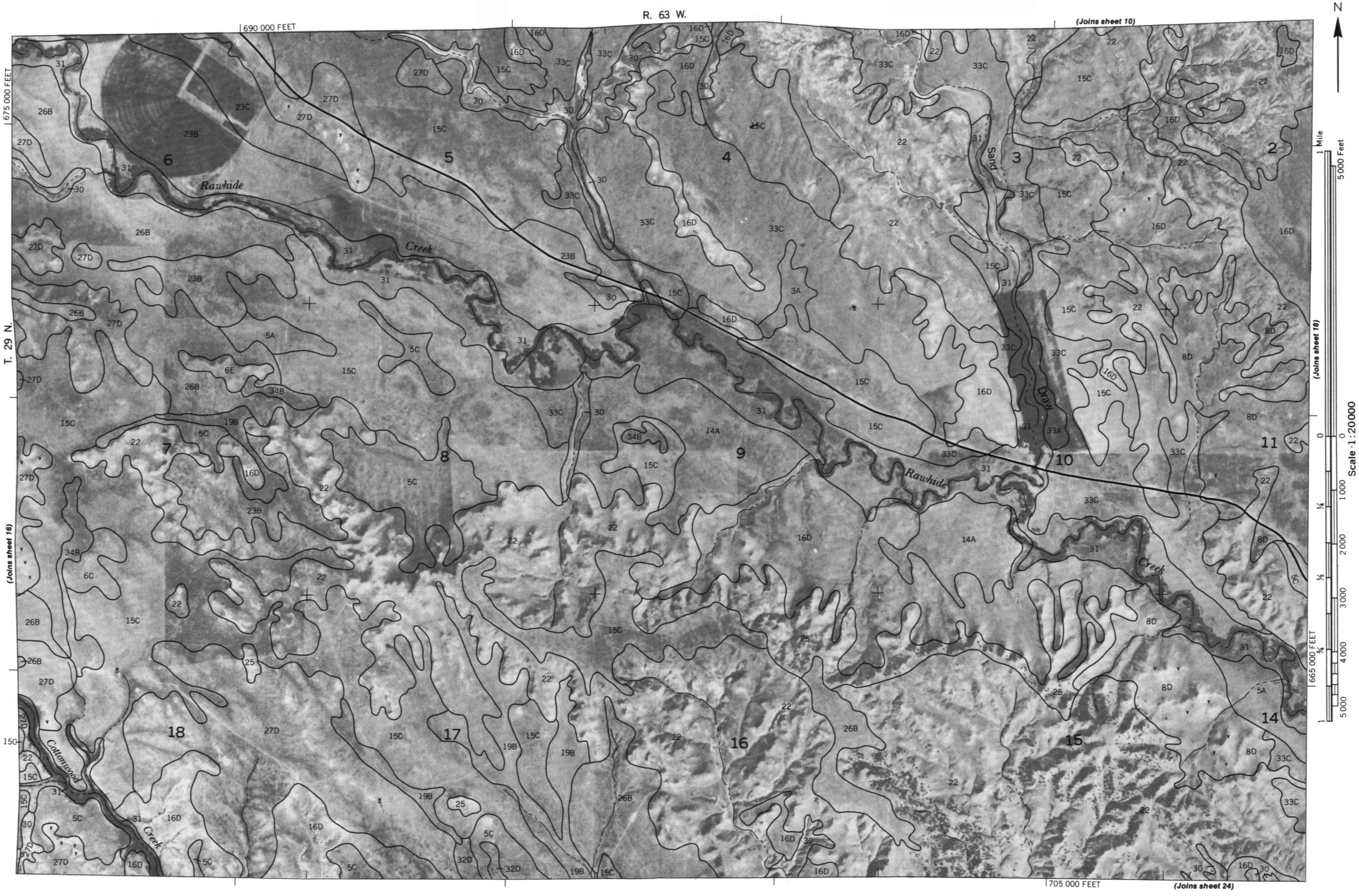
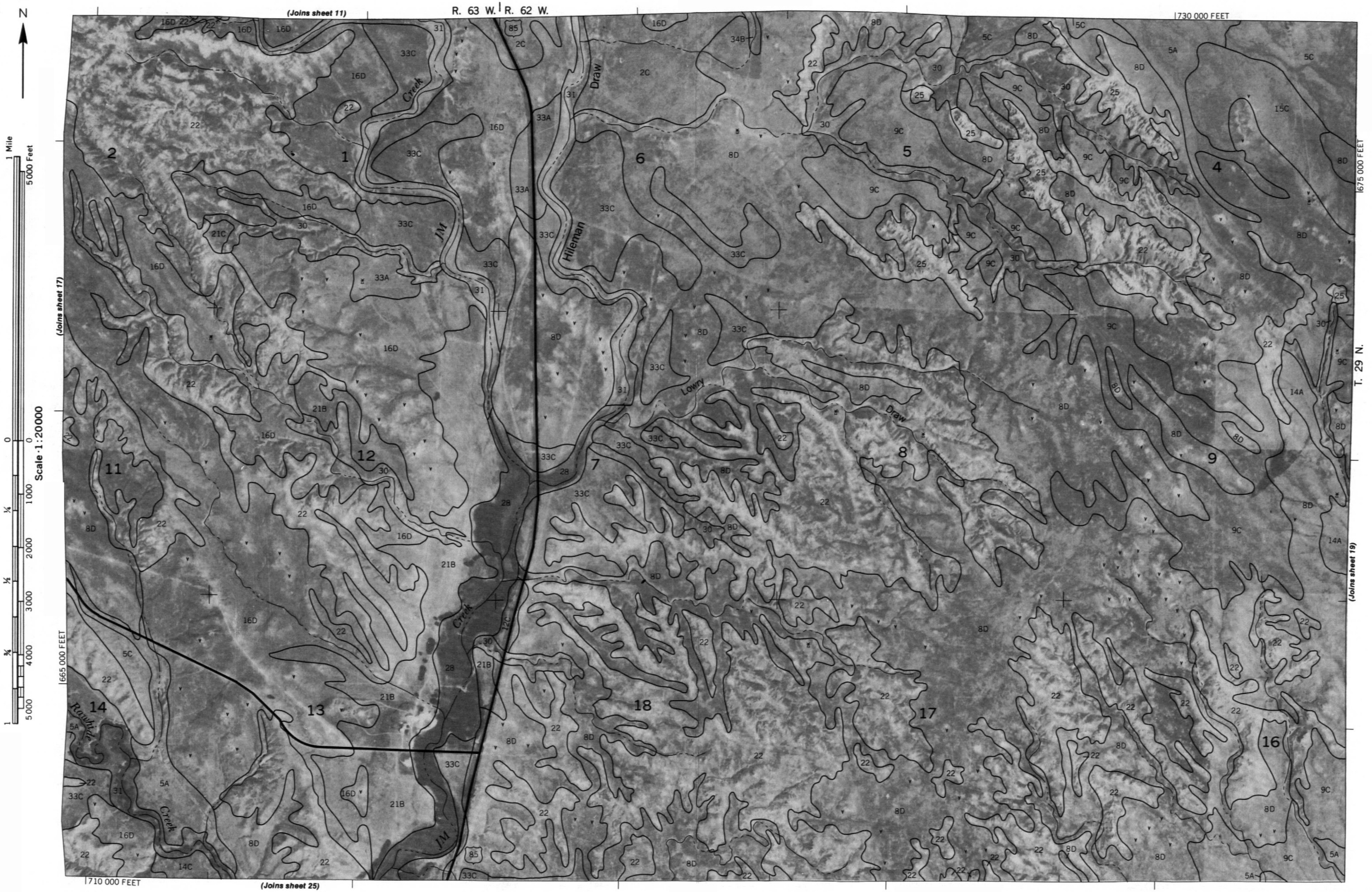


GOSHEN COUNTY, WYOMING, NORTH PART NO. 17

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

(18)

GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 18

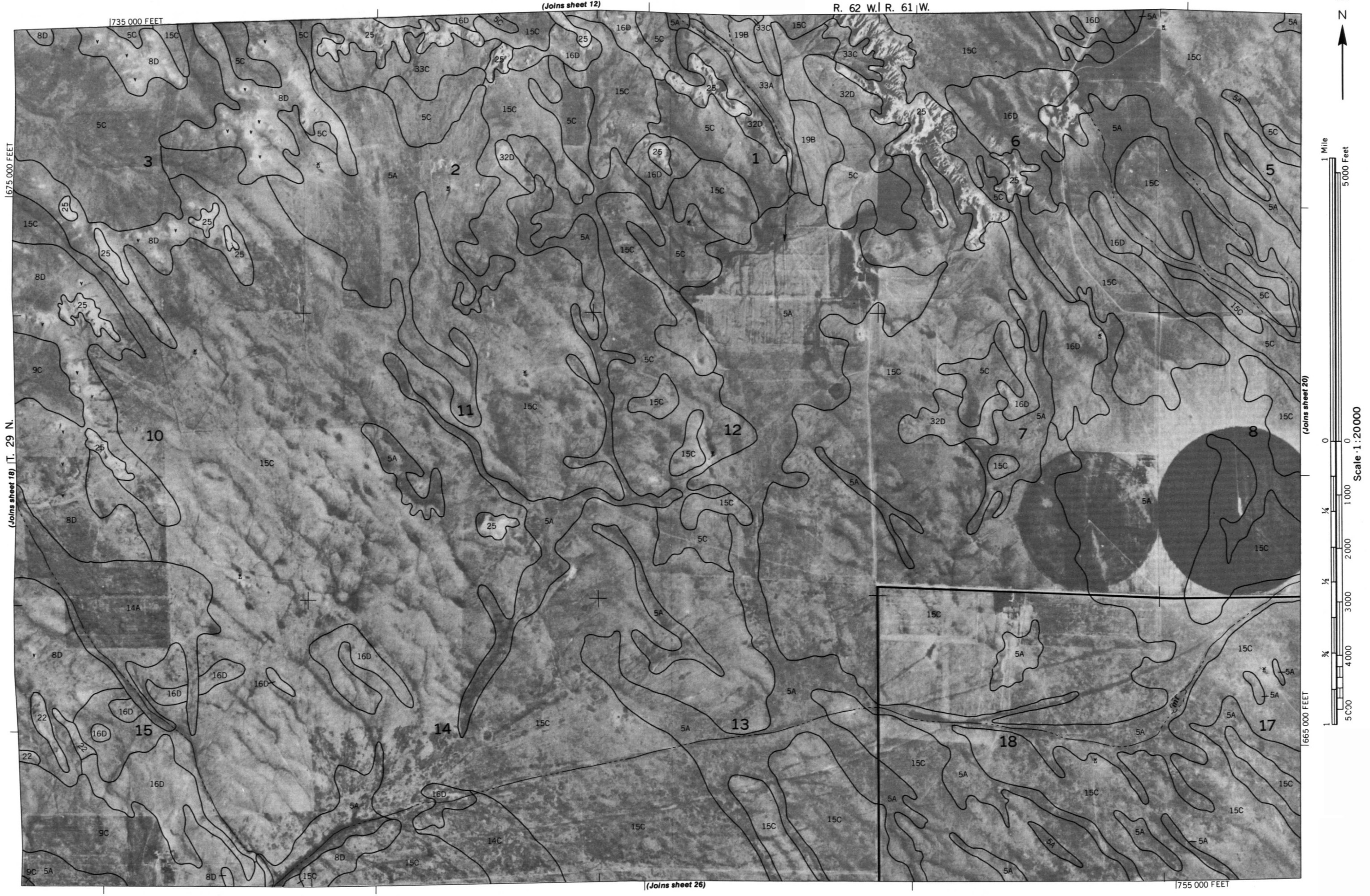


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 18

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 19

⑲



GOSHEN COUNTY, WYOMING, NORTH PART NO. 19

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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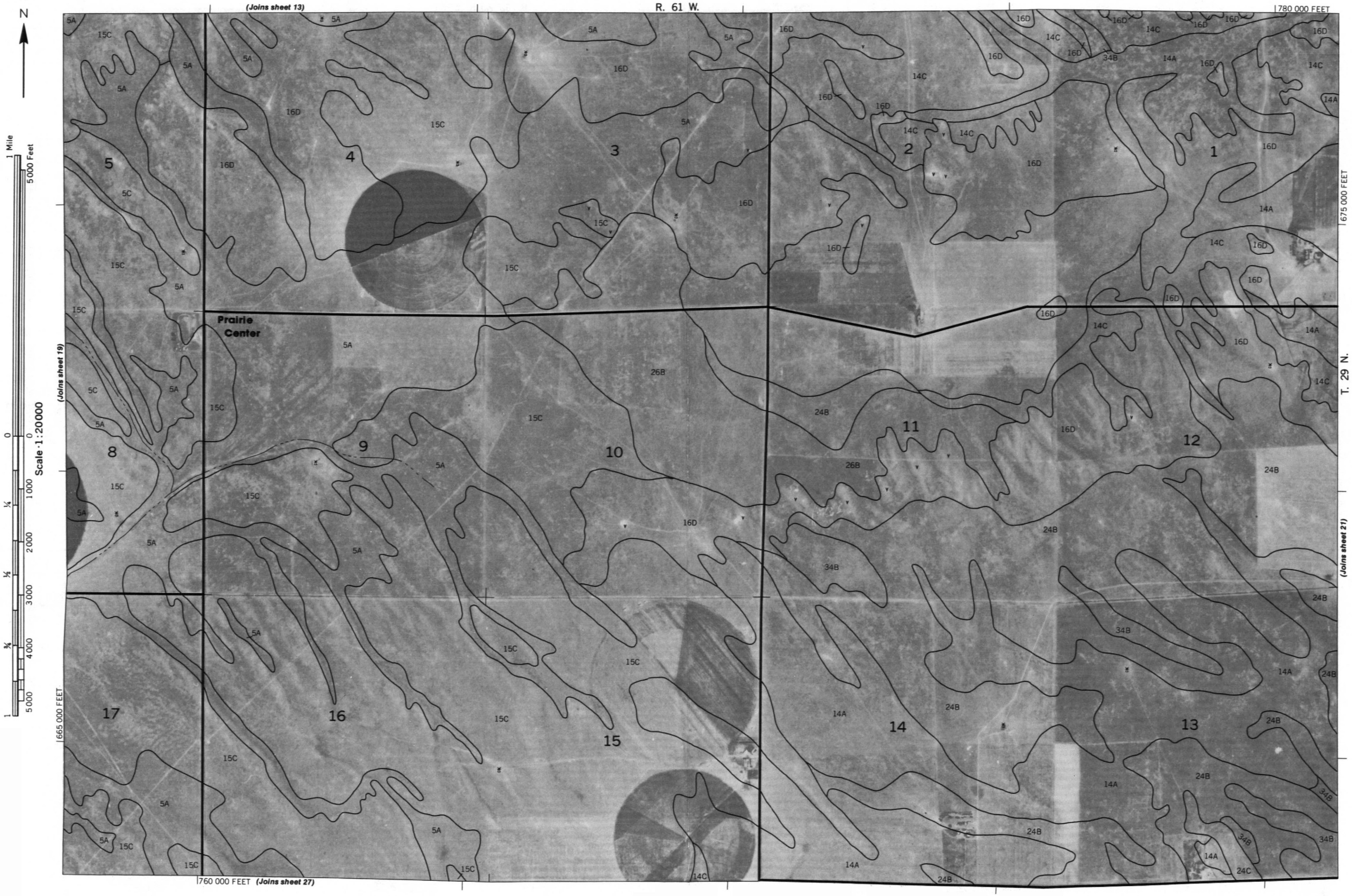
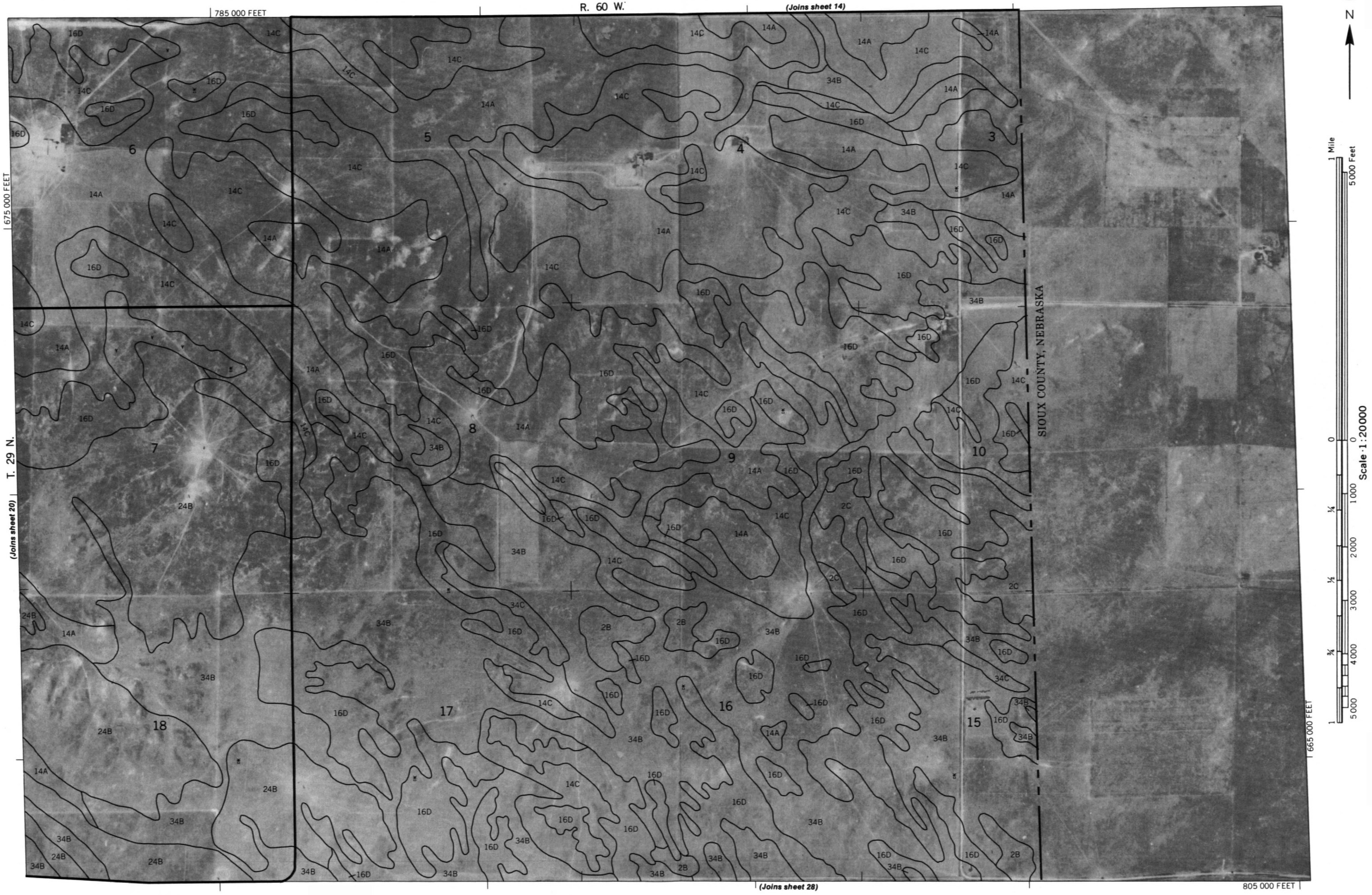
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 20



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 20

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 21



GOSHEN COUNTY, WYOMING, NORTH PART NO. 21

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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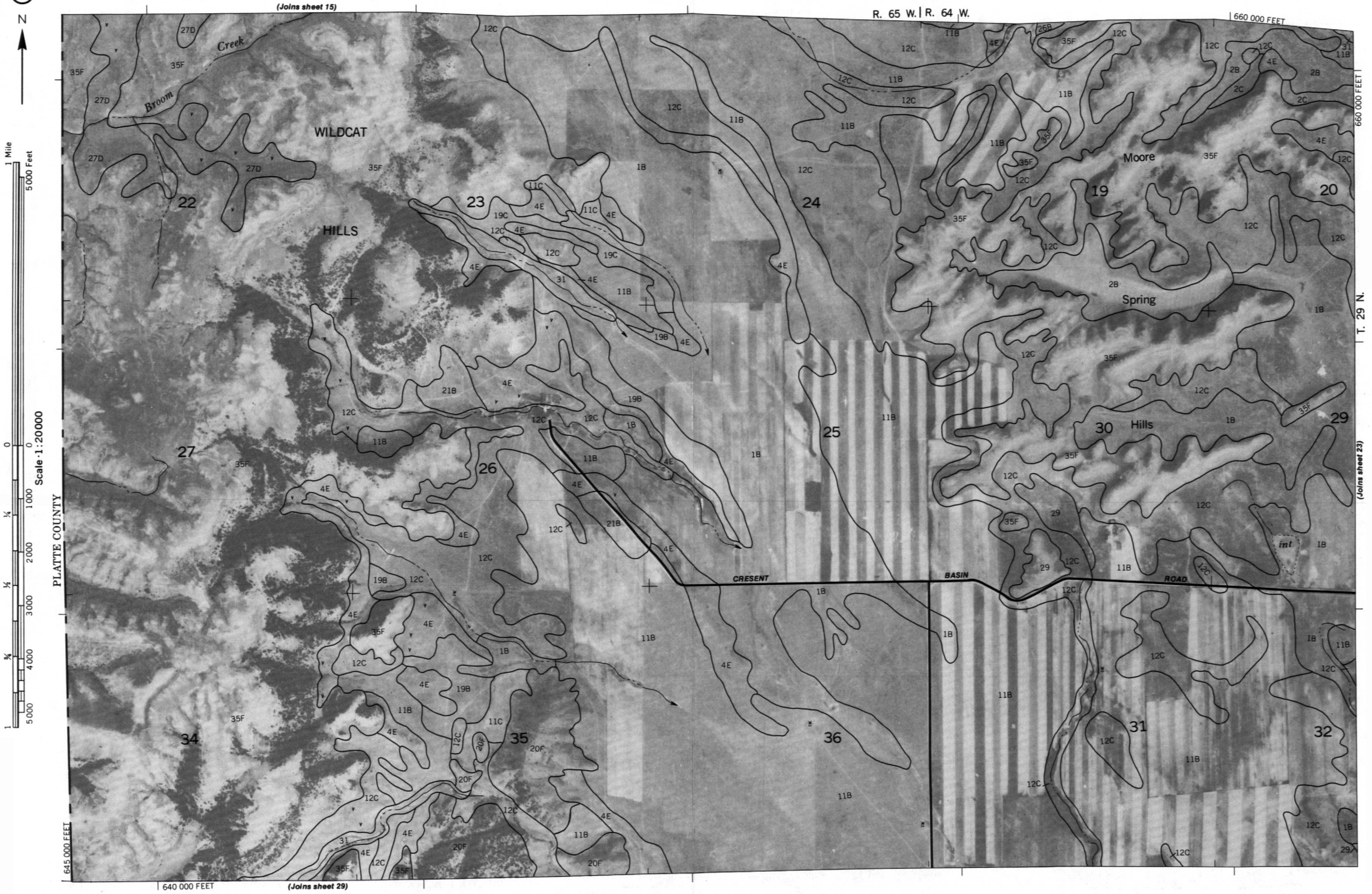
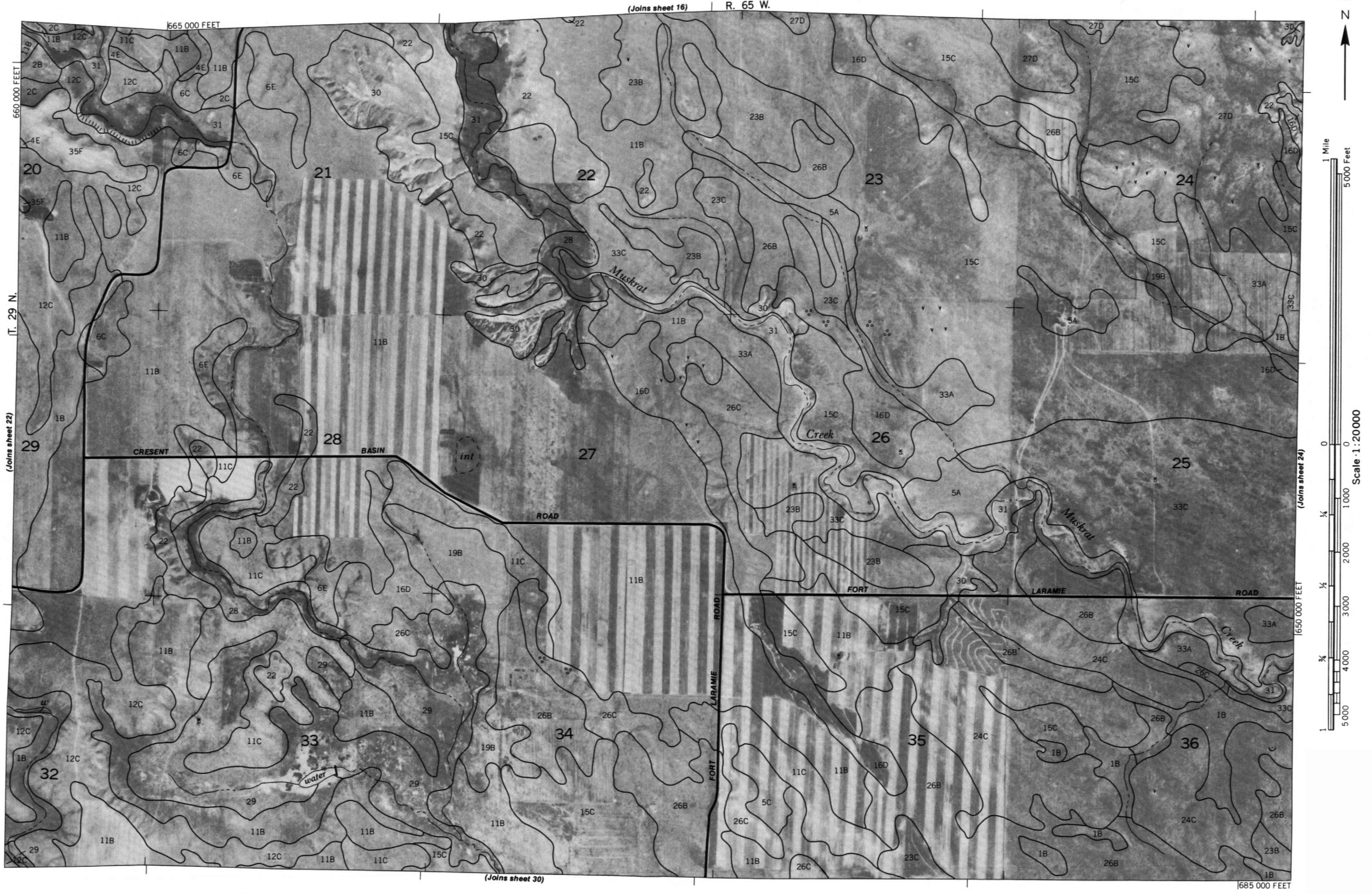
GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 22



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 22

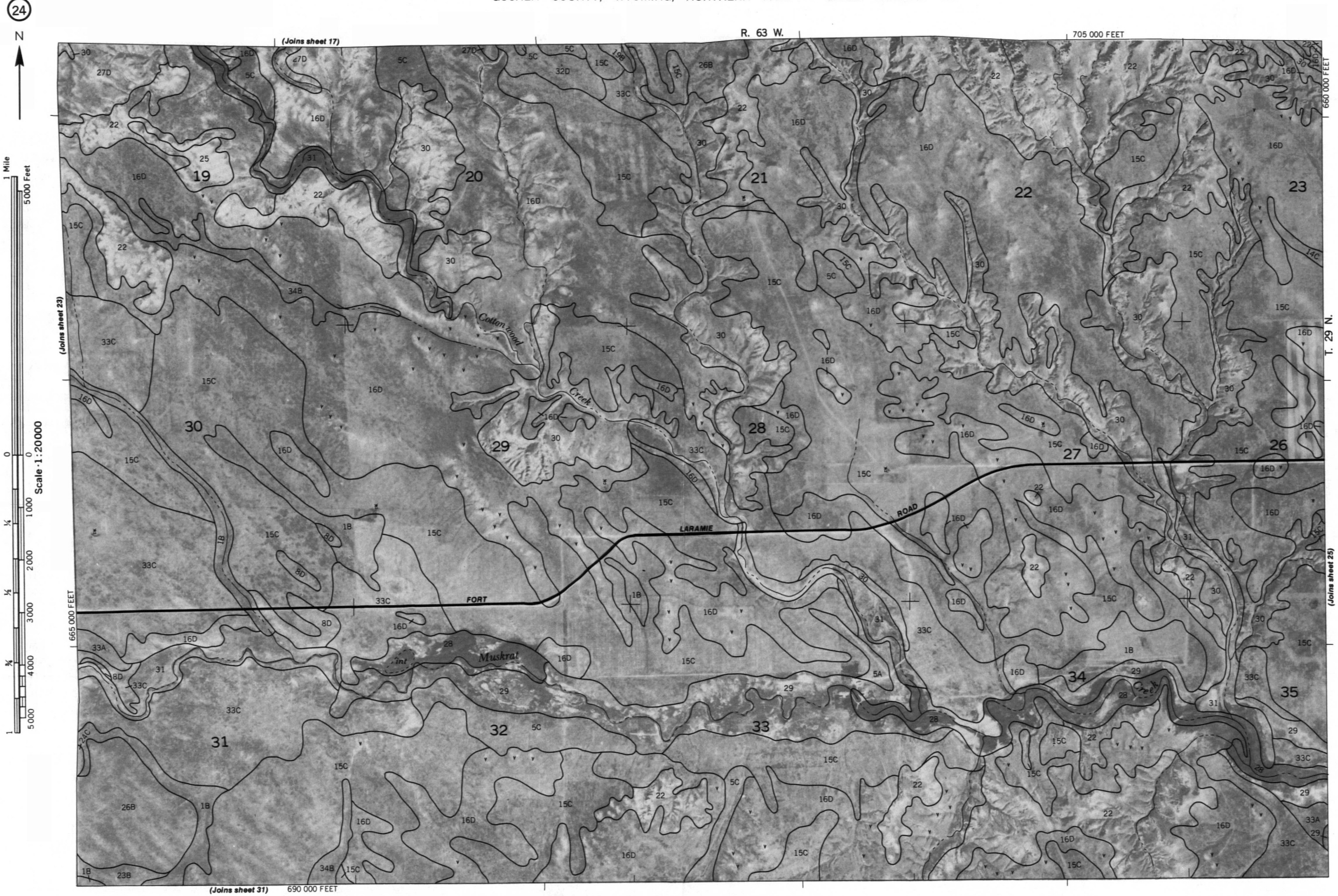
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 23



GOSHEN COUNTY, WYOMING, NORTH PART NO. 23

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 24



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 24

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 25

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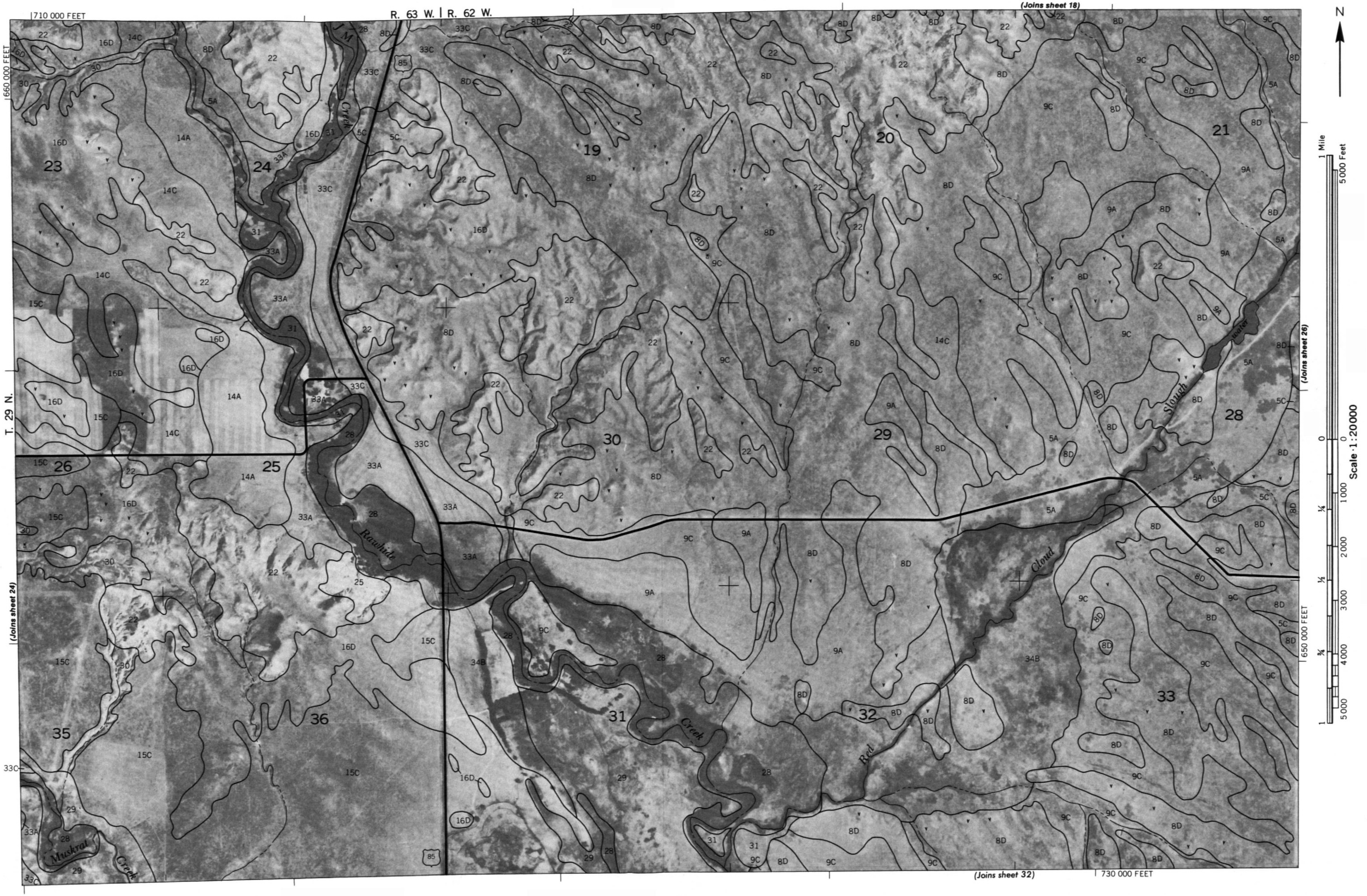
GOSHEN COUNTY, WYOMING, NORTH PART NO. 25

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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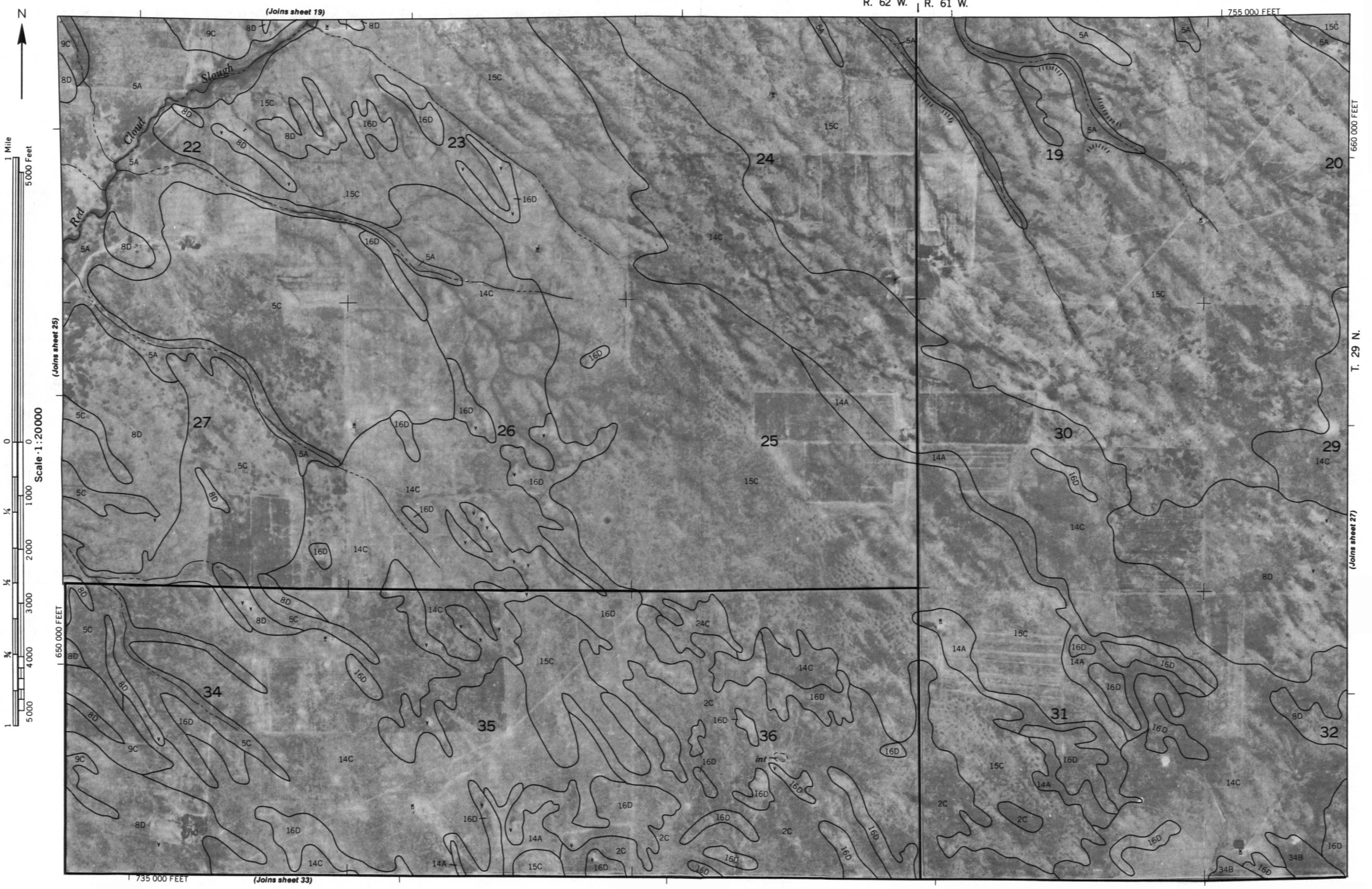
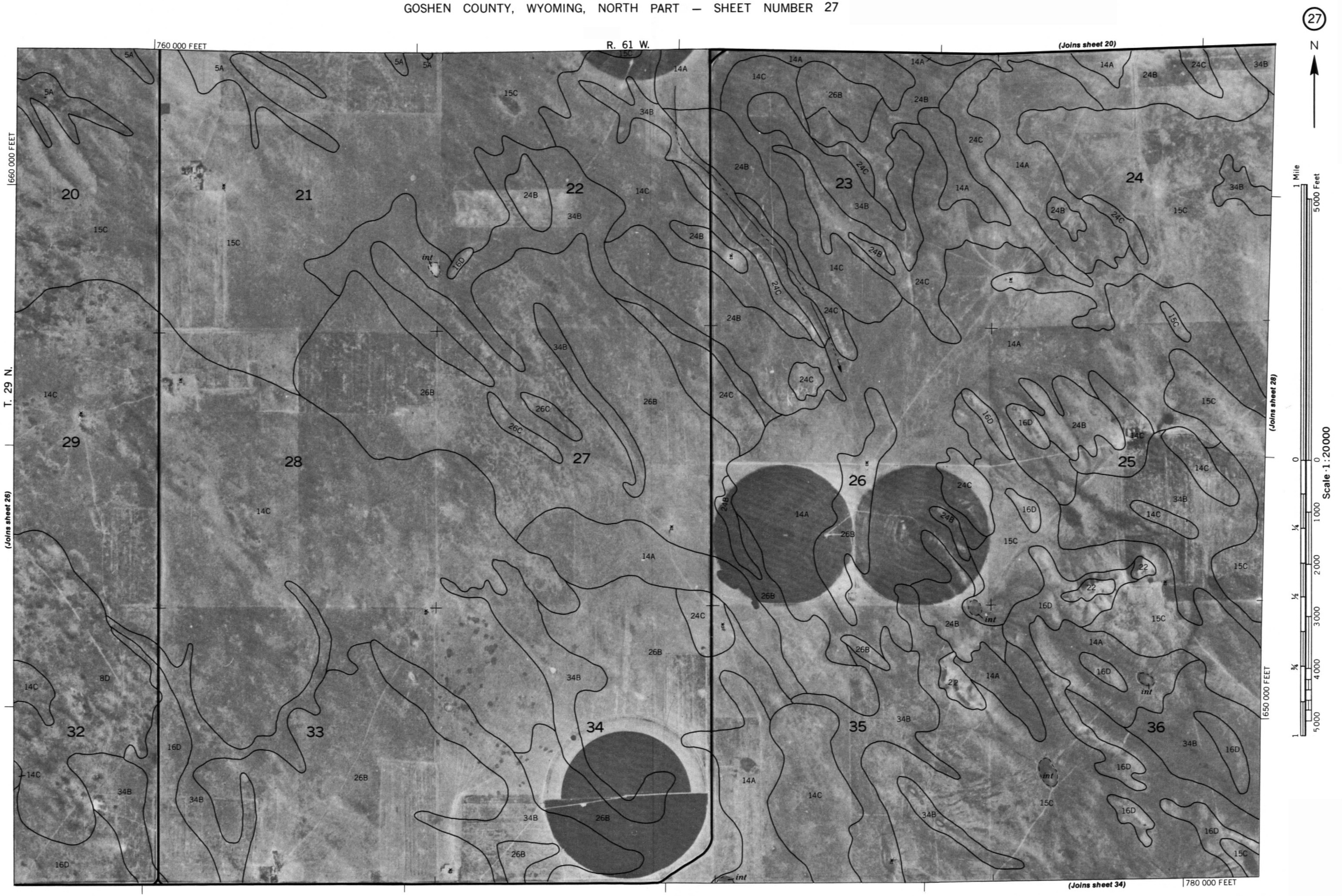
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 26



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 26

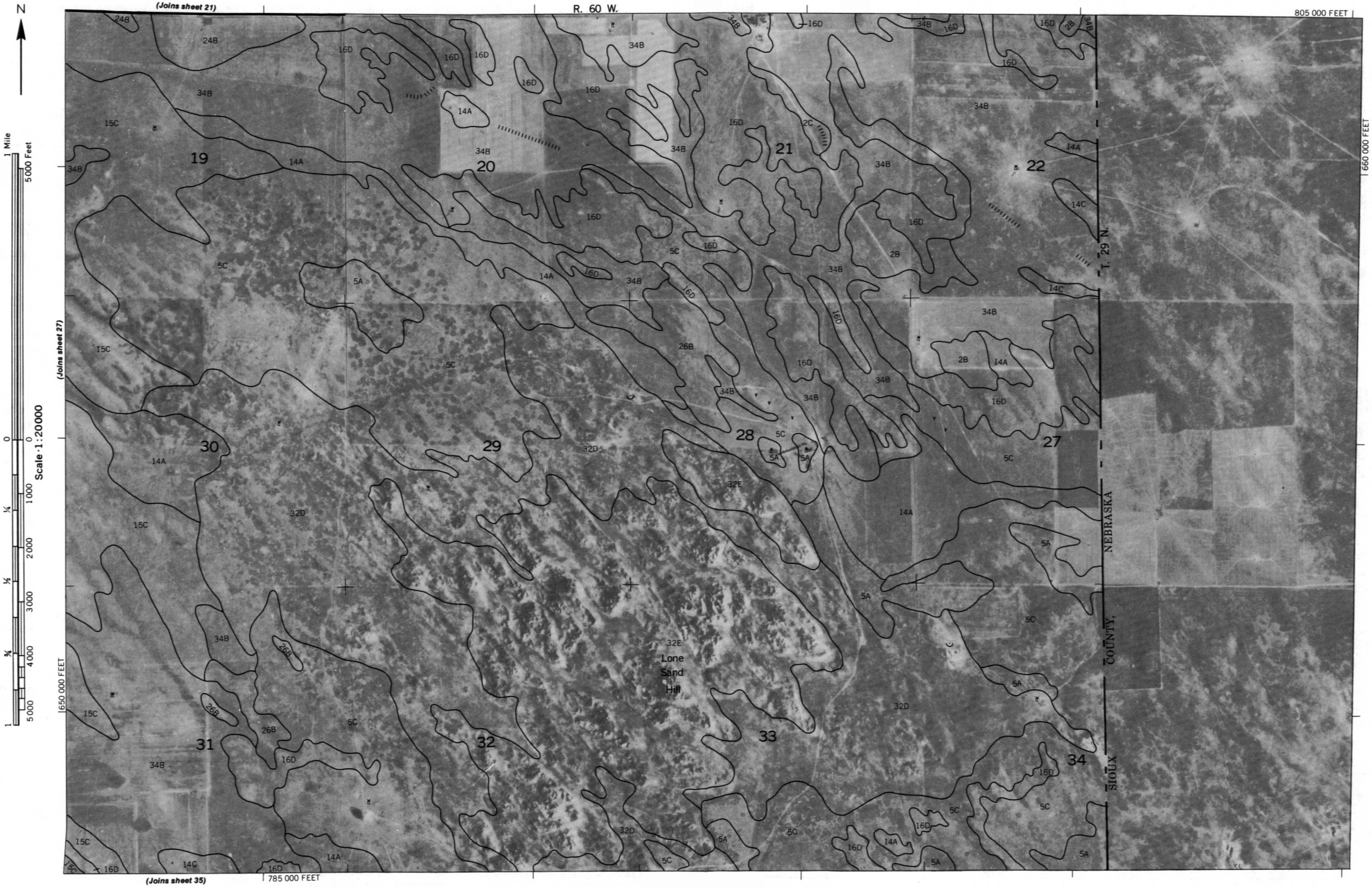
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 27



GOSHEN COUNTY, WYOMING, NORTH PART NO. 27

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

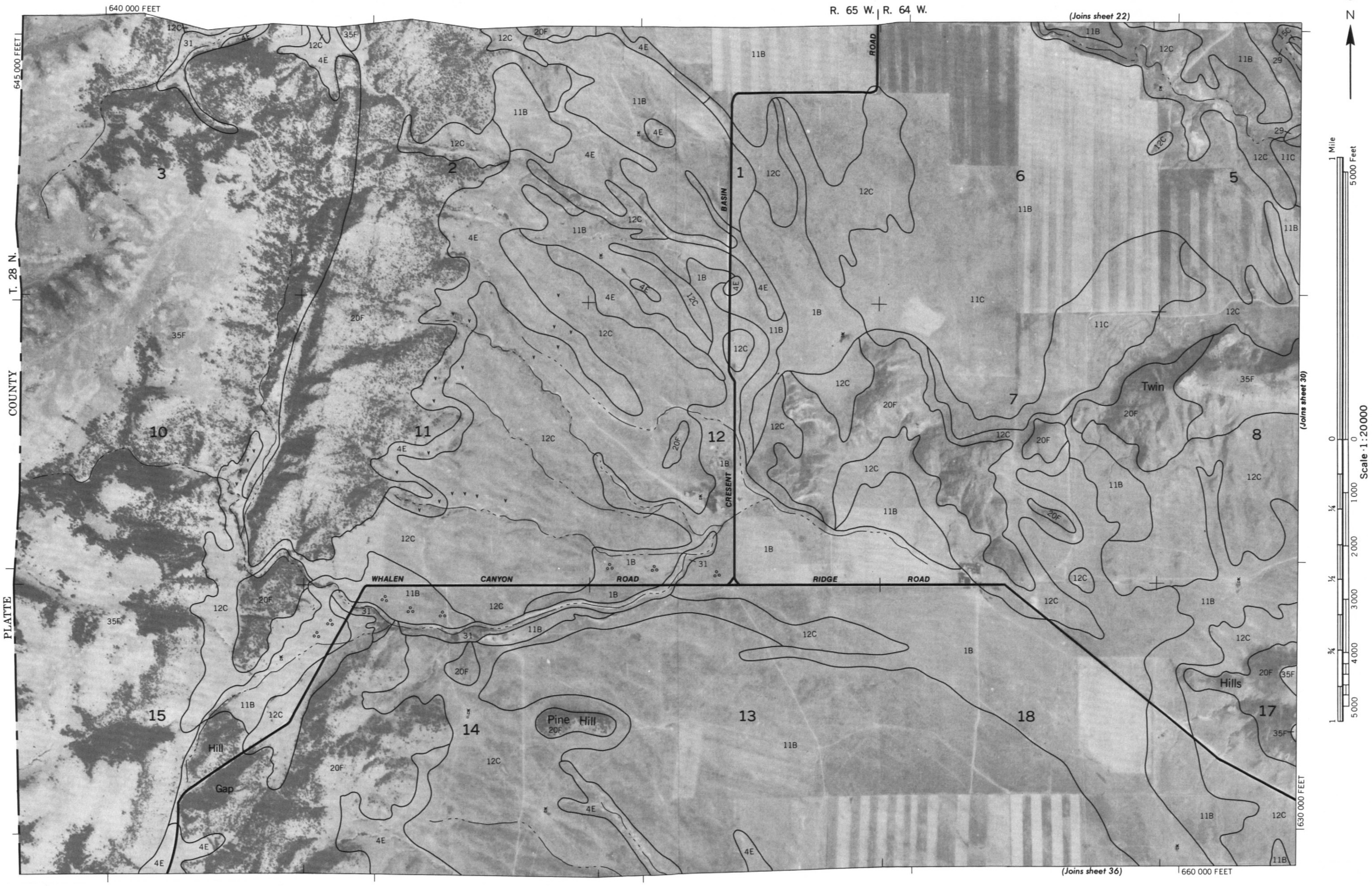
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 28



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 28

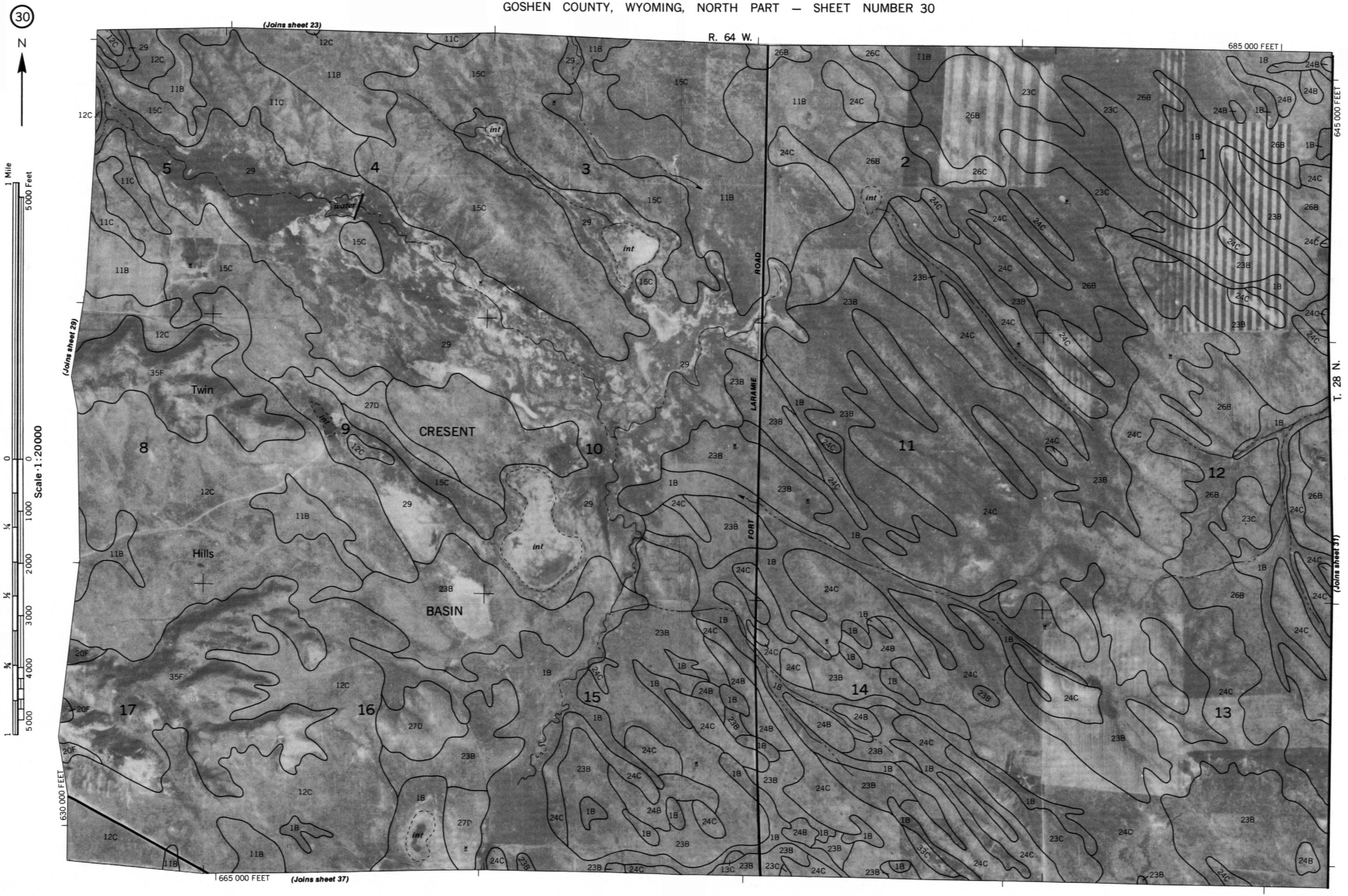
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 29



GOSHEN COUNTY, WYOMING, NORTH PART NO. 29

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 30



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 30

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 31

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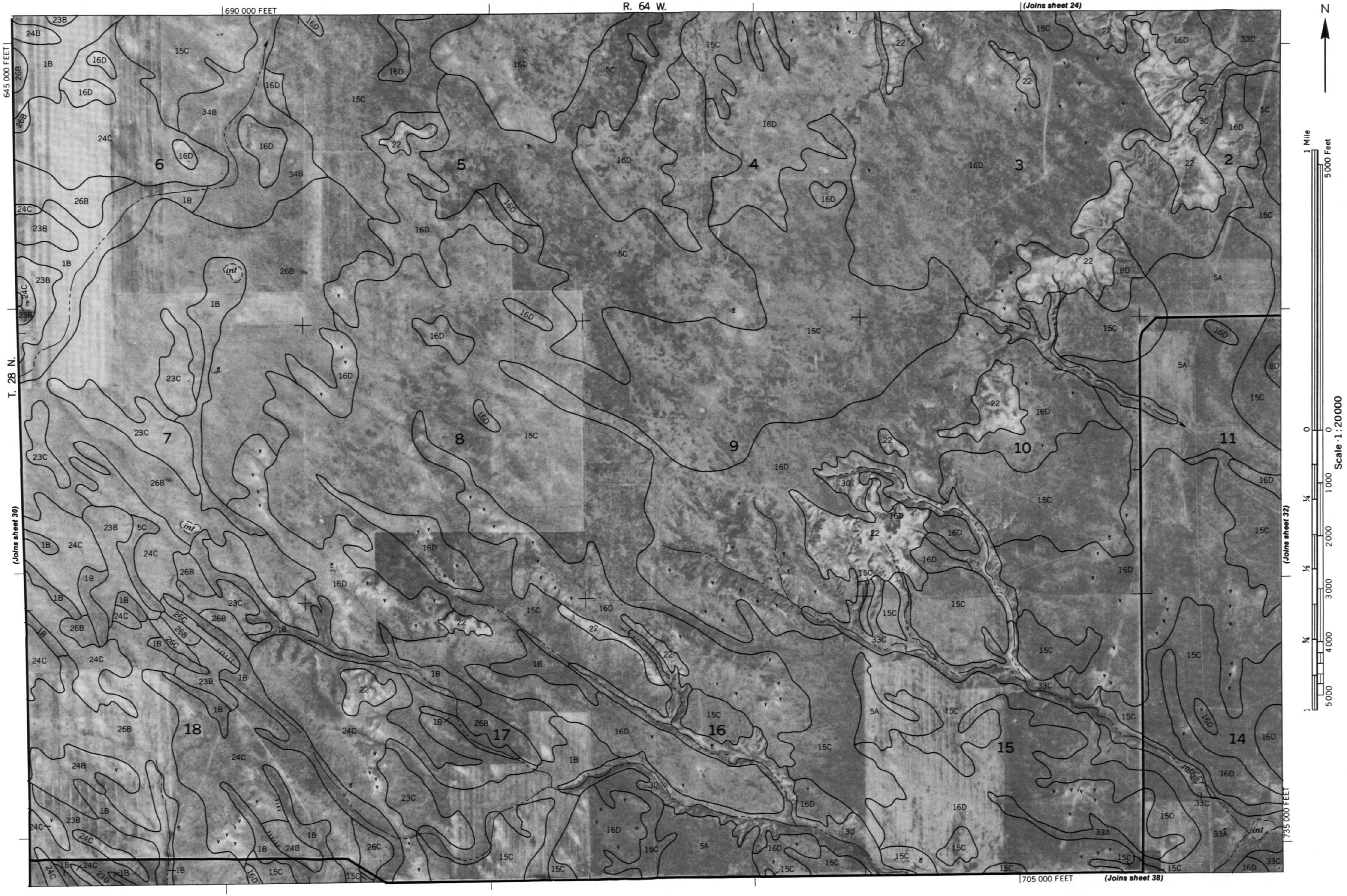
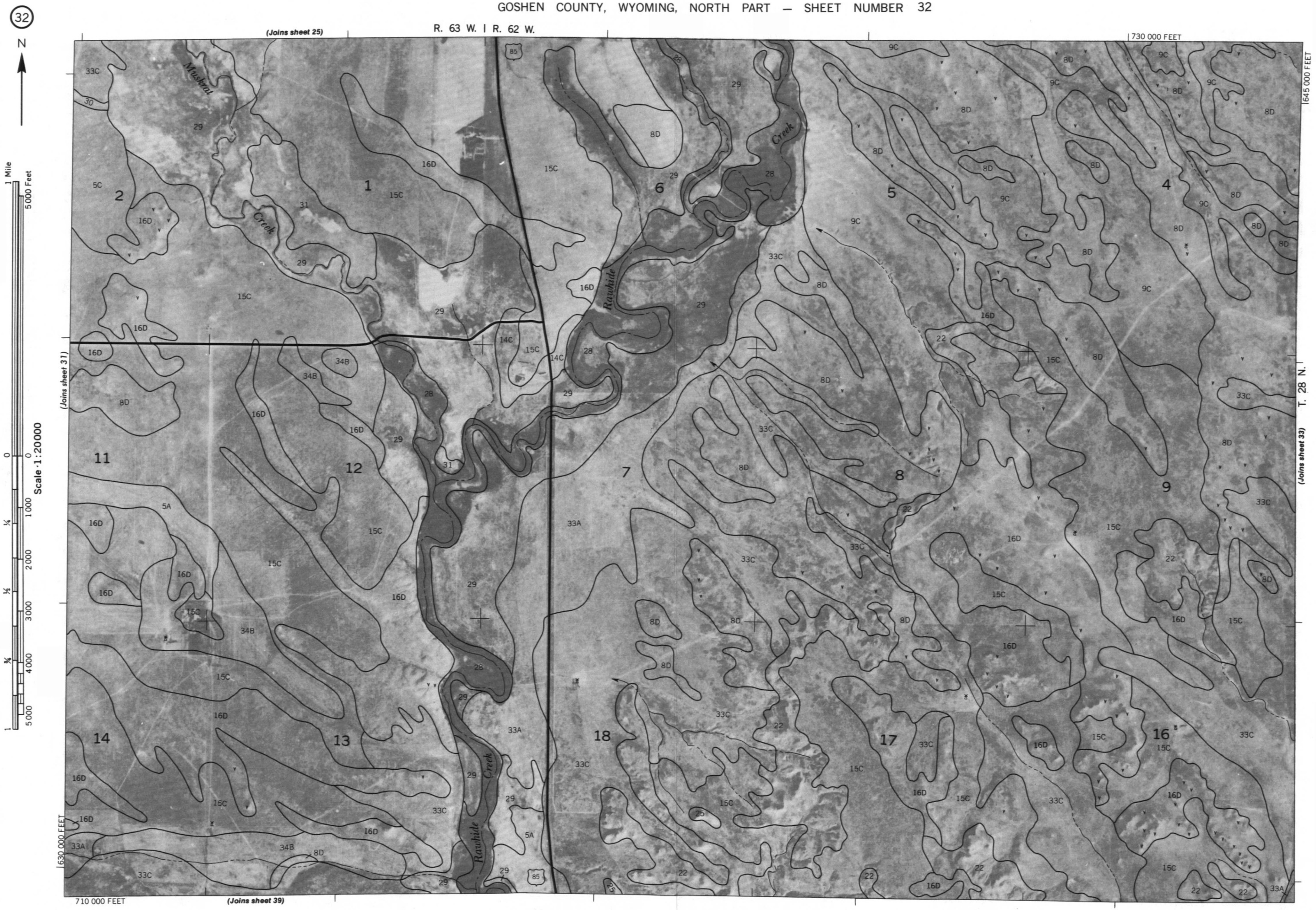


GOSHEN COUNTY, WYOMING, NORTH PART NO. 31

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

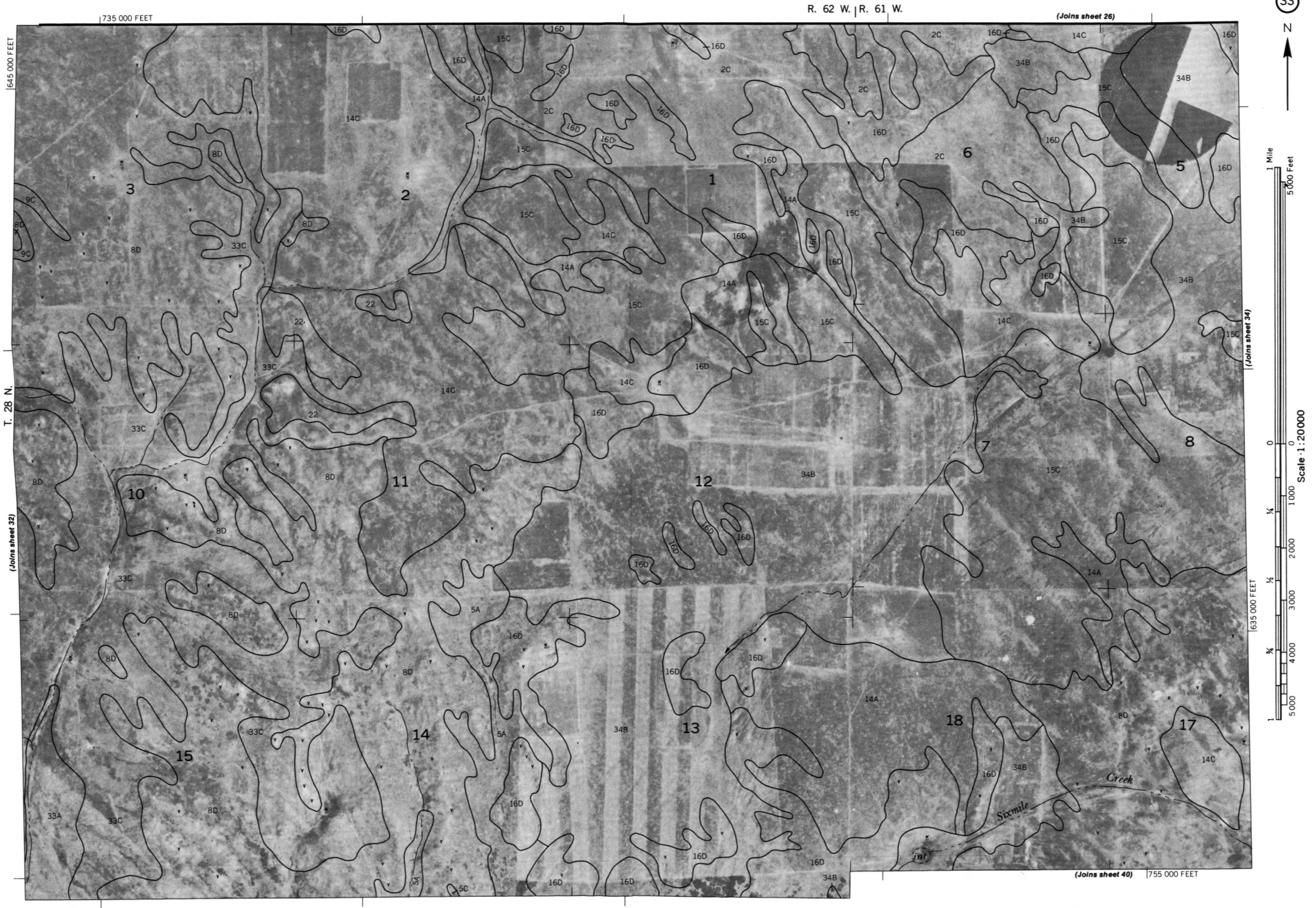
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 32



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned

GOSHEN COUNTY, WYOMING, NORTH PART NO. 32

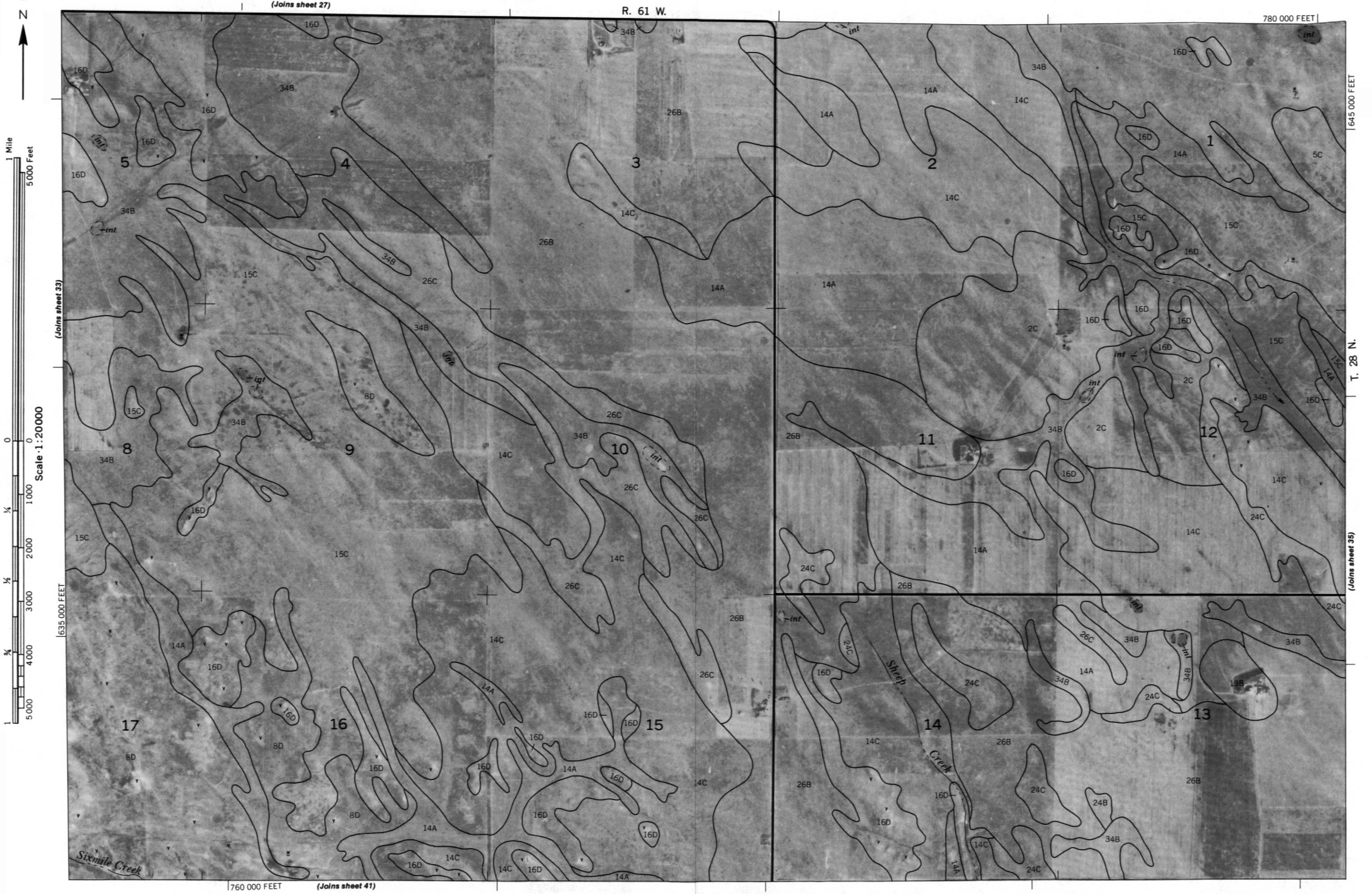
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 33



GOSHEN COUNTY, WYOMING, NORTH PART NO. 33

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

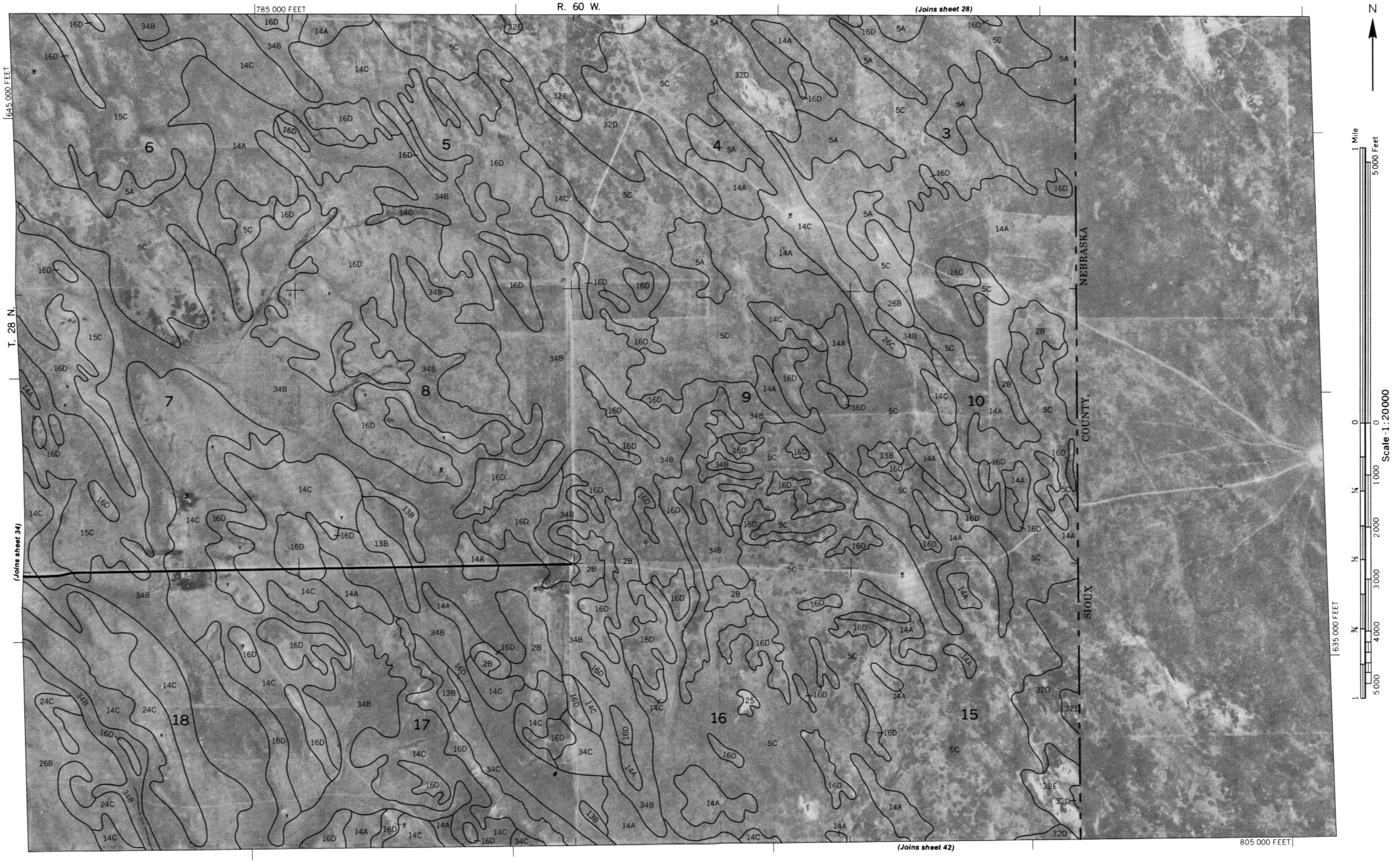
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 34



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 34

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 35



GOSHEN COUNTY, WYOMING, NORTH PART NO. 35

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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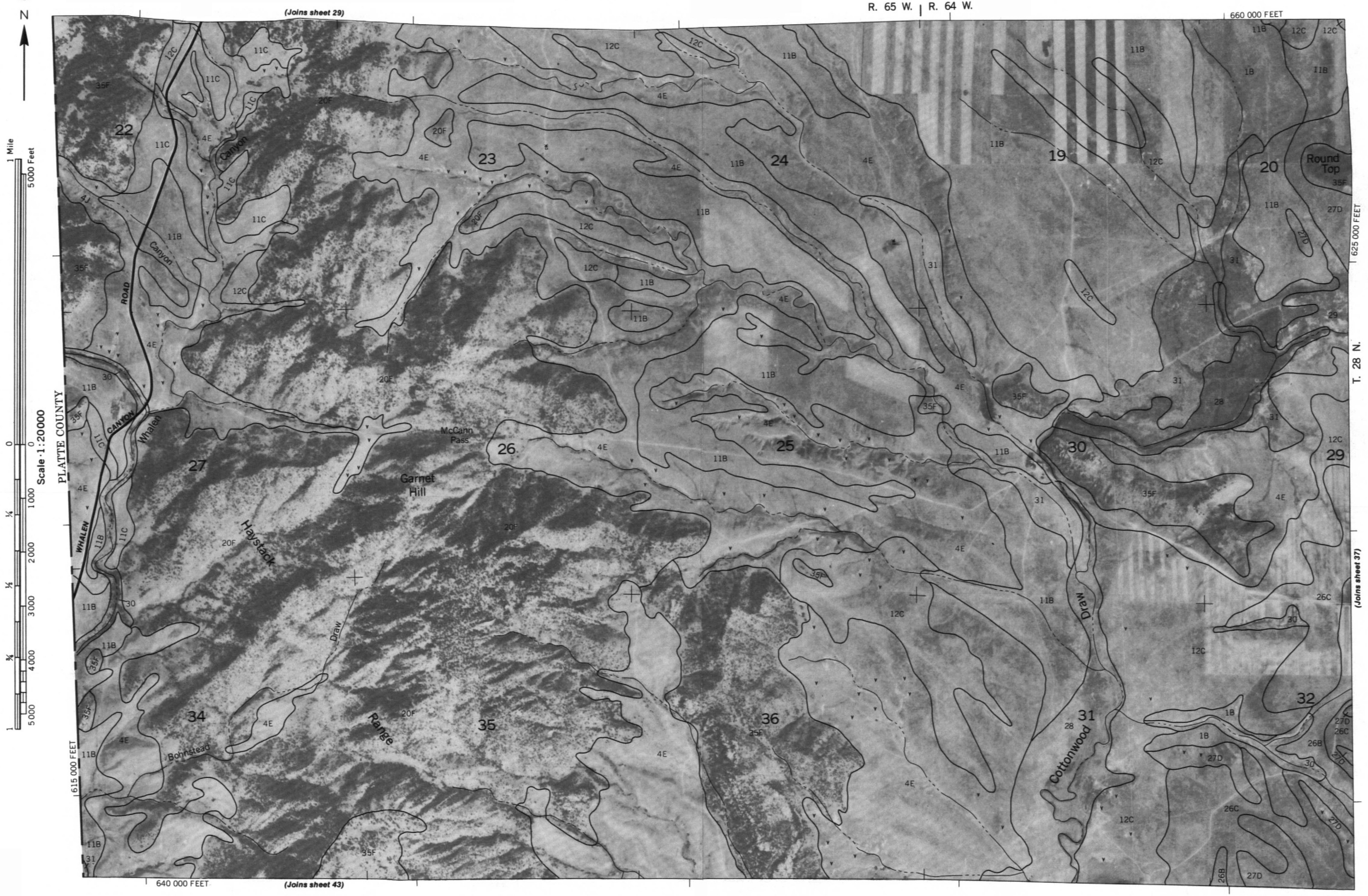
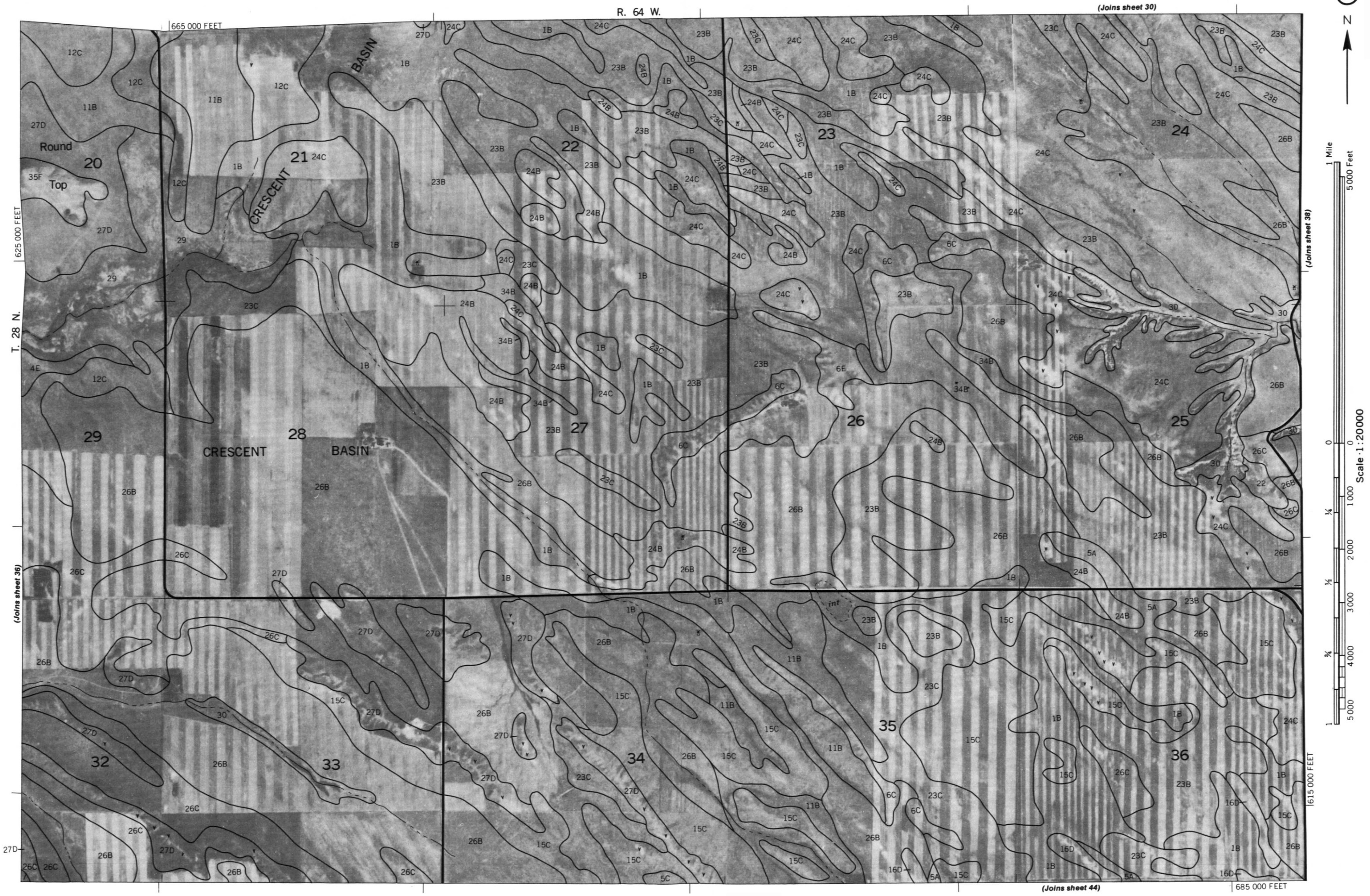
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 36



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 36

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 37



GOSHEN COUNTY, WYOMING, NORTH PART NO. 37

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 38

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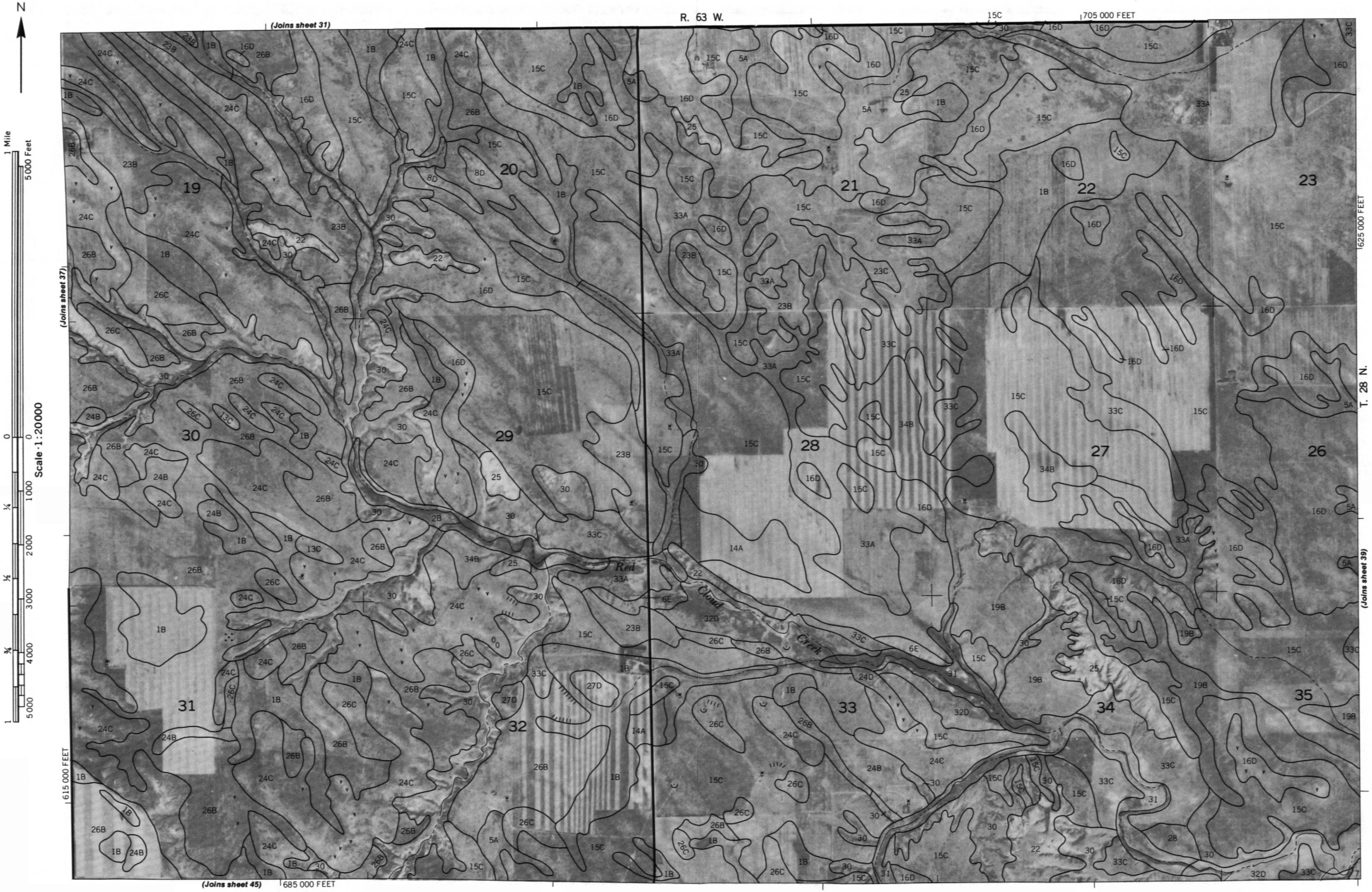
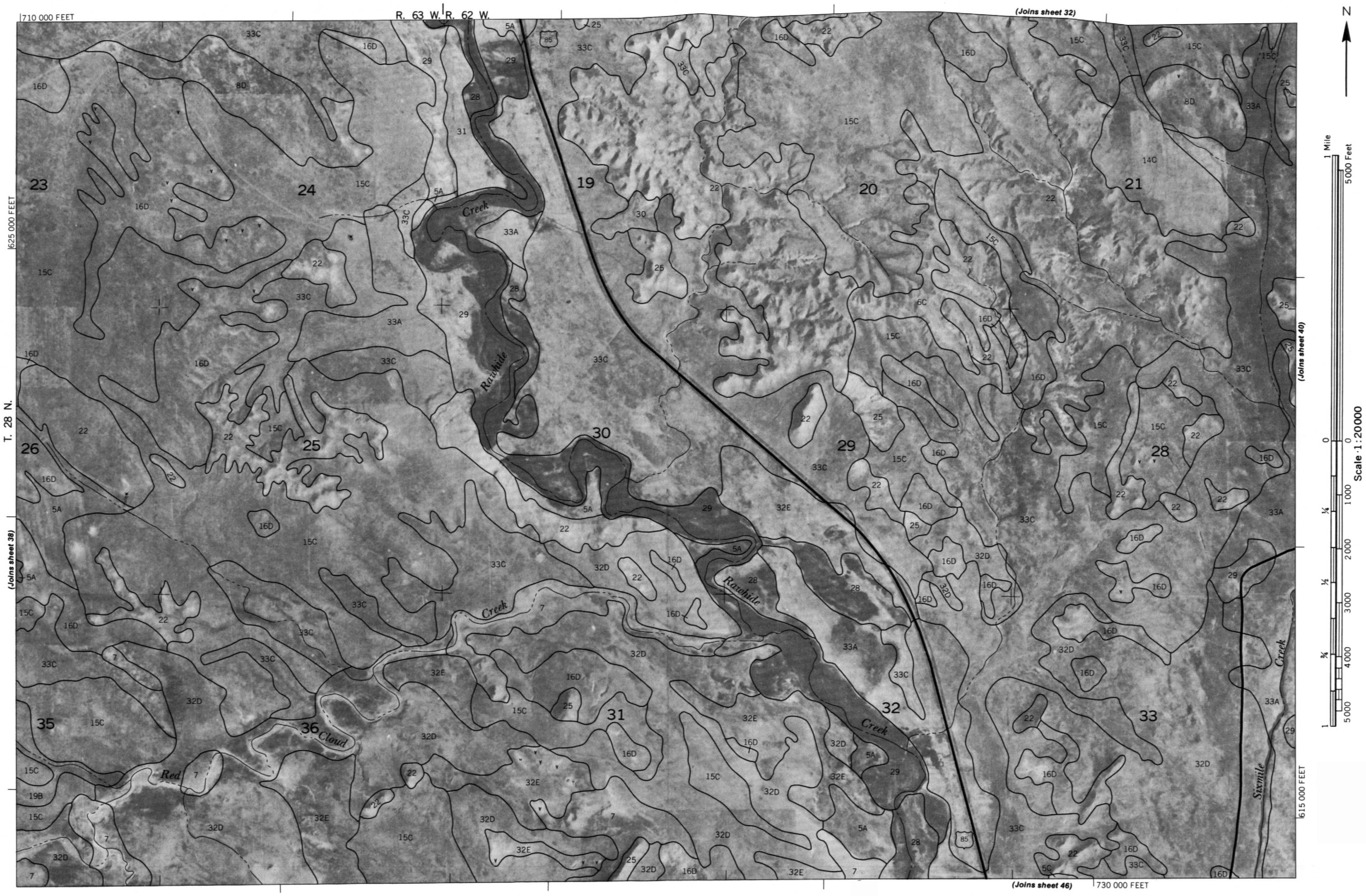


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 38

GOSHEN COUNTY, WYOMING, NORTH PART NO. 39

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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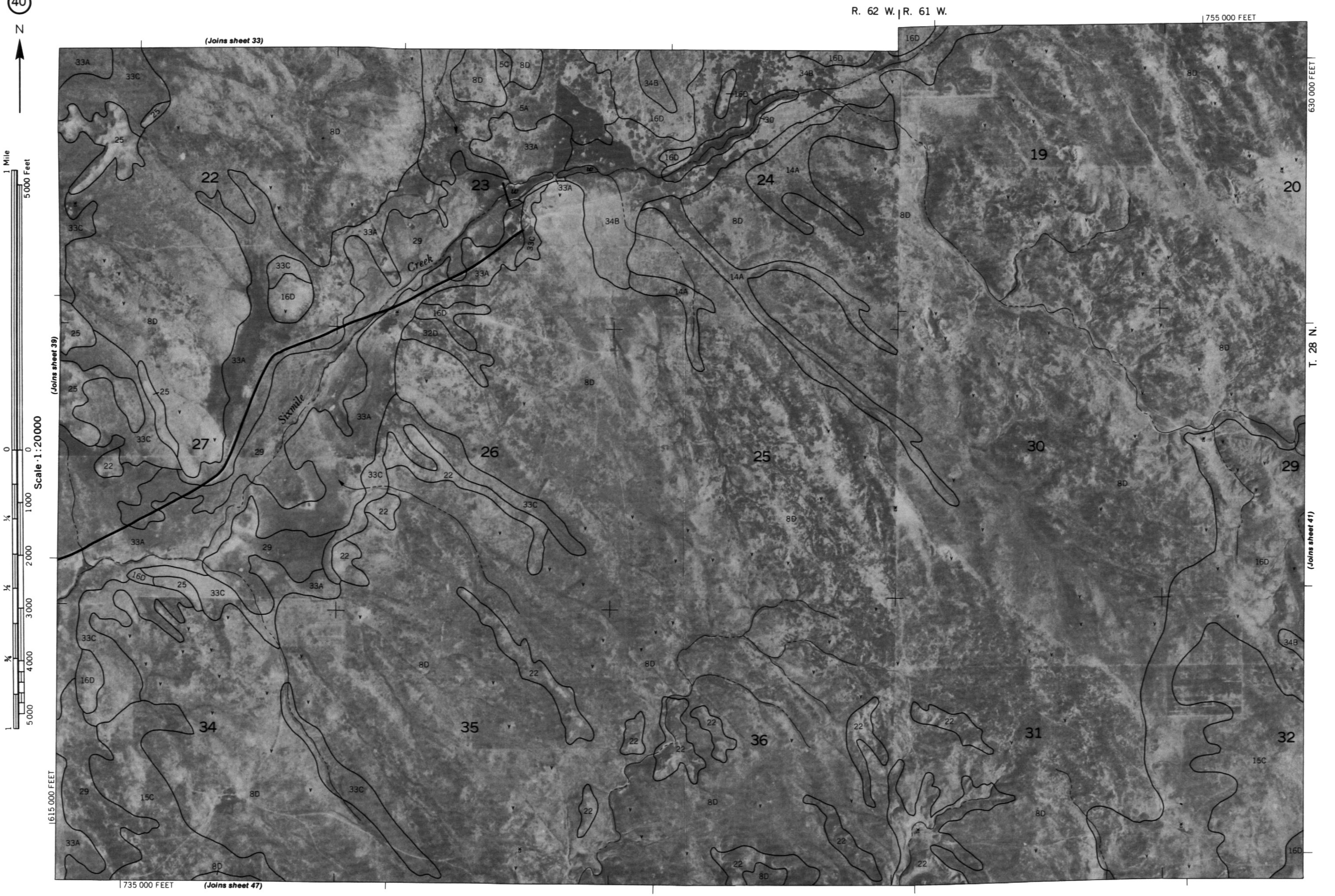
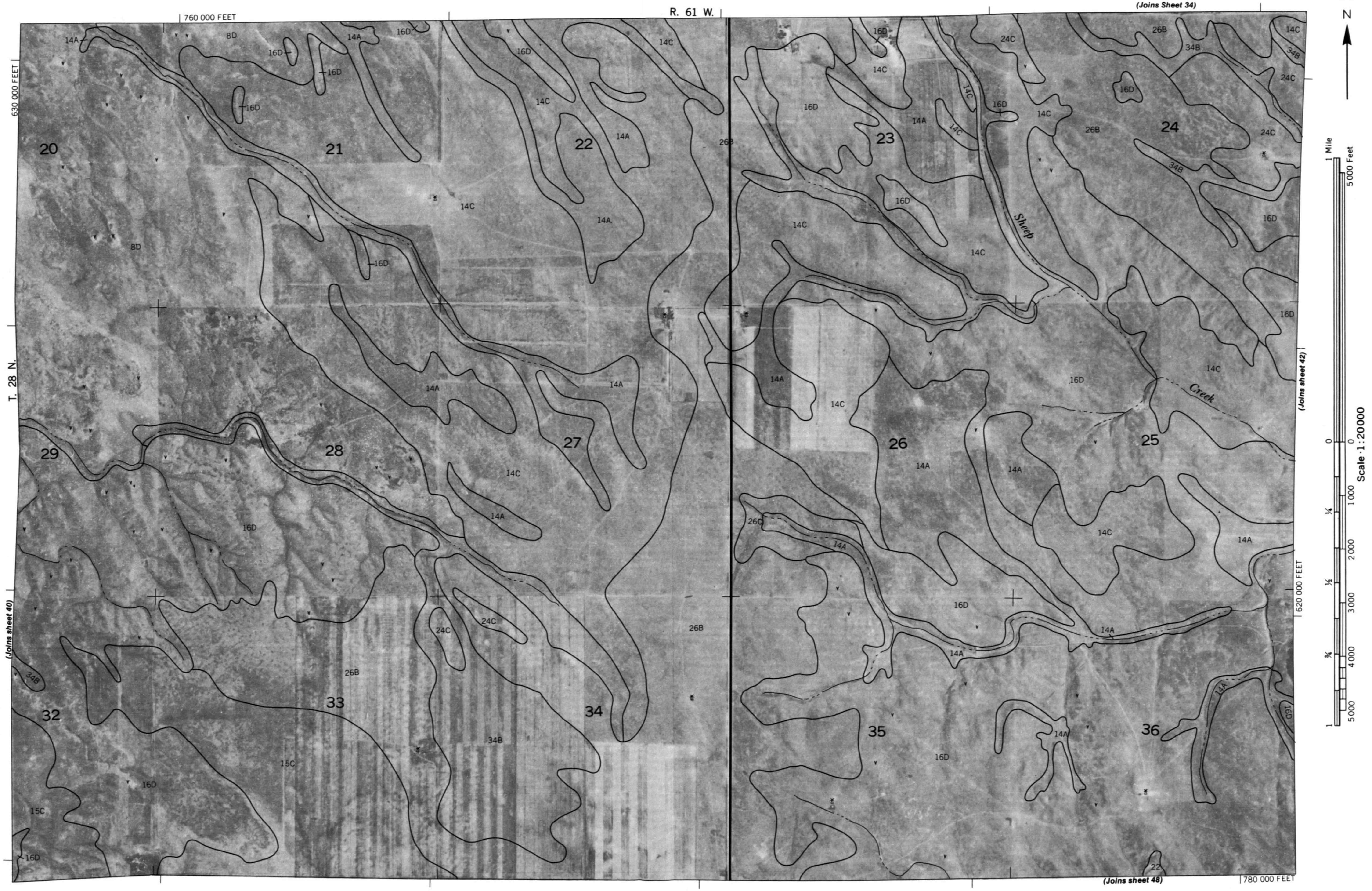
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 40



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 40

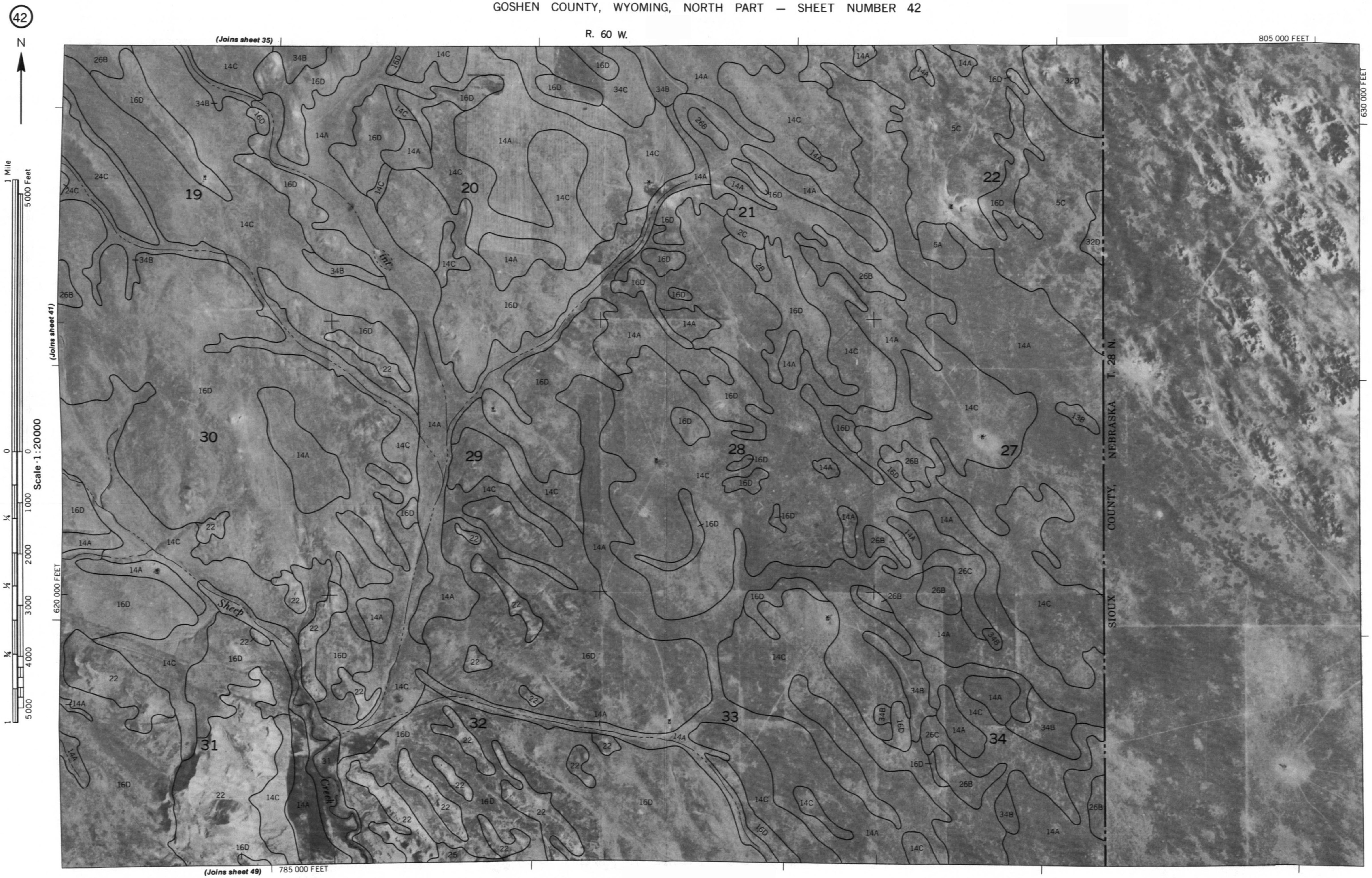
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 41



GOSHEN COUNTY, WYOMING, NORTH PART NO. 41

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

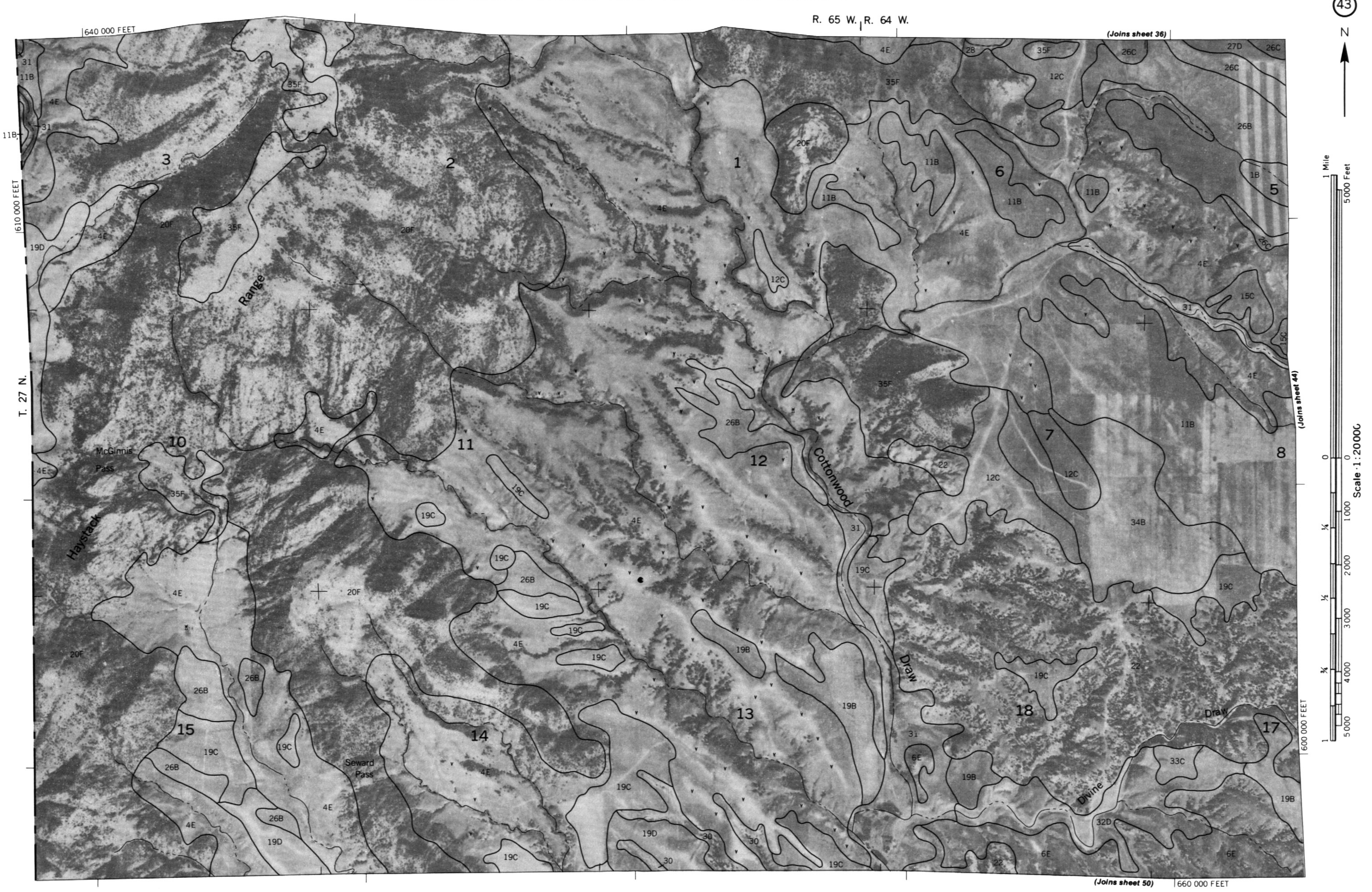
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 42



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 42

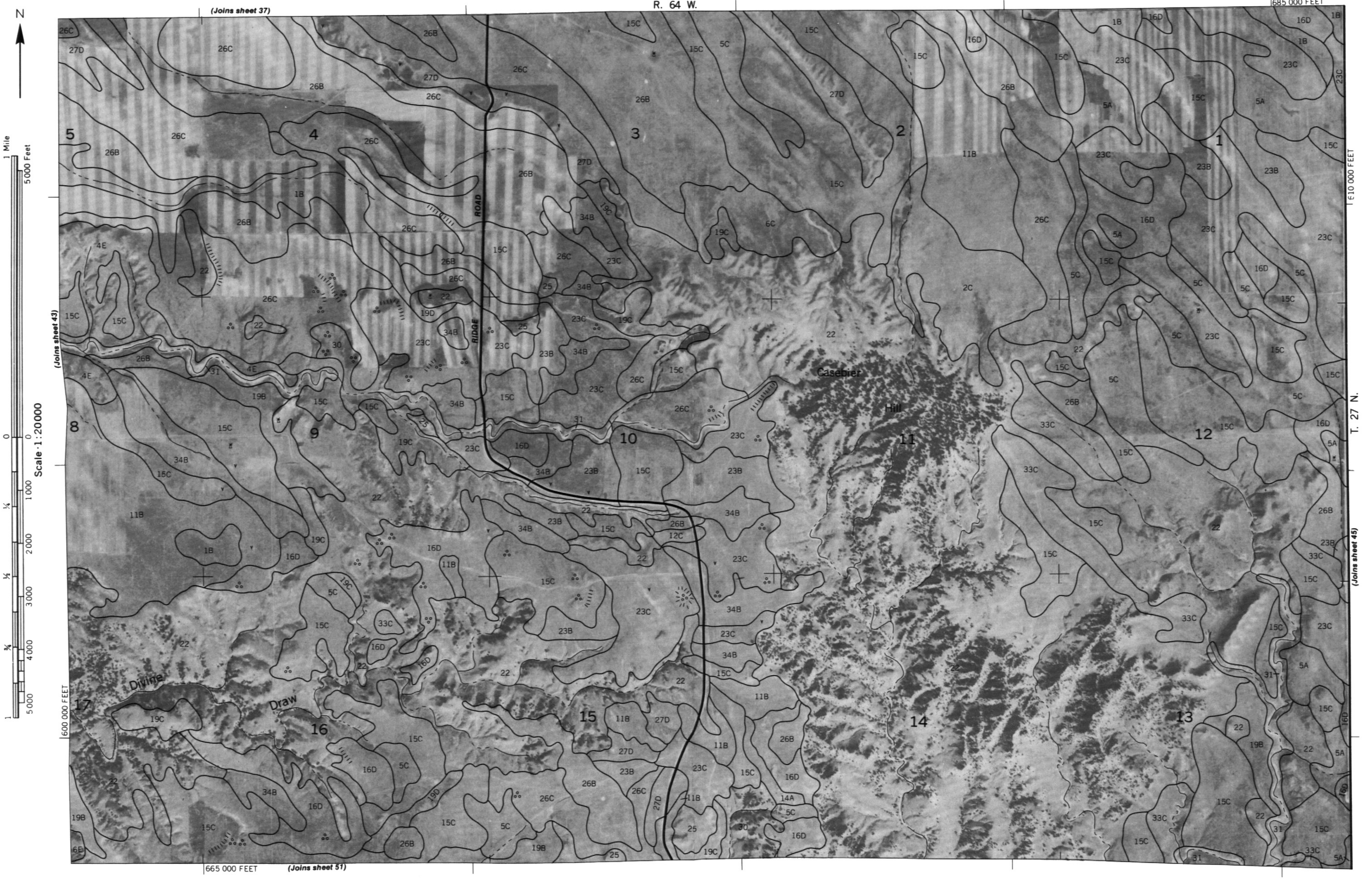
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 43



GOSHEN COUNTY, WYOMING, NORTH PART NO. 43

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

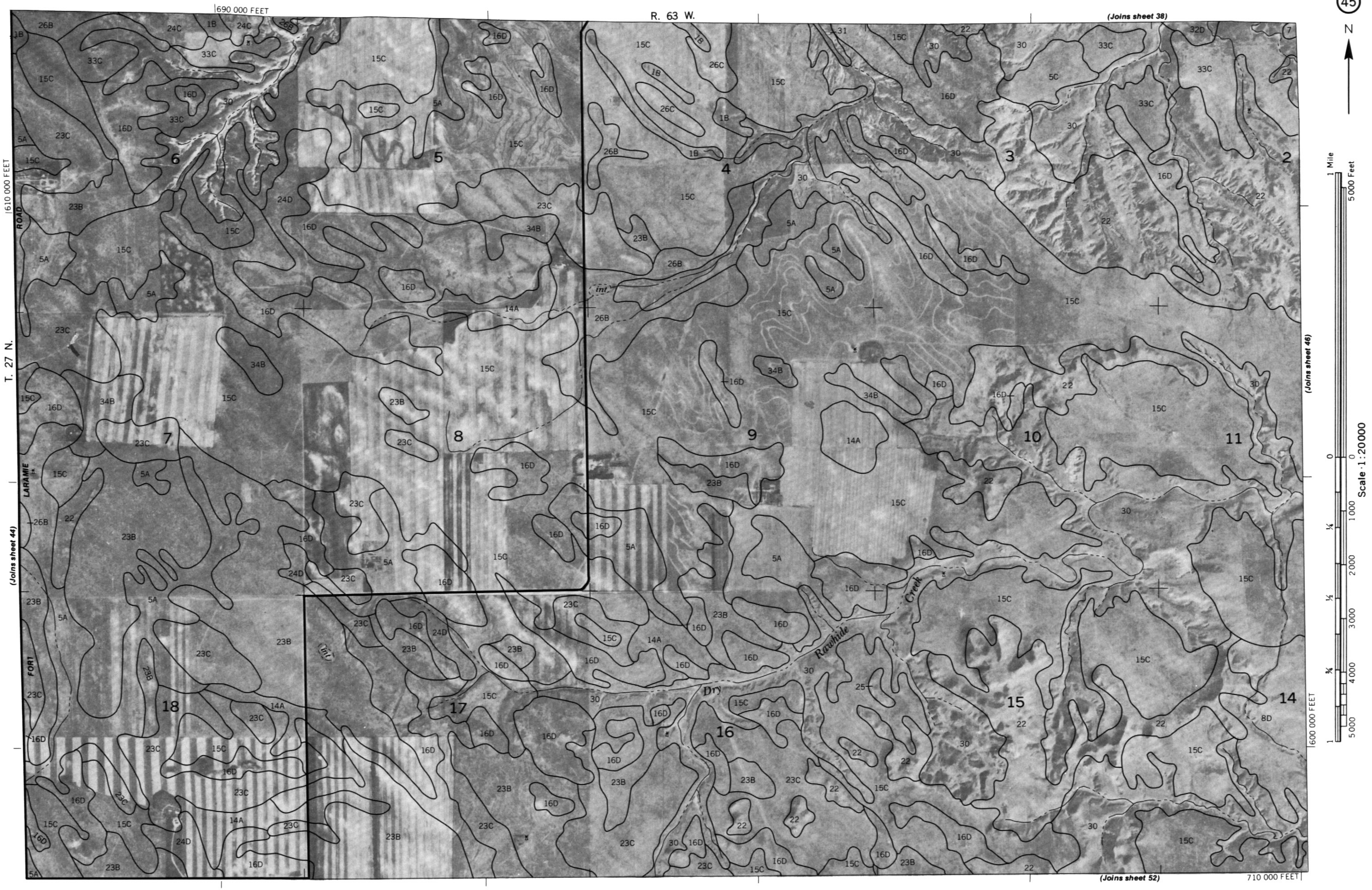
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 44



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 44

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 45

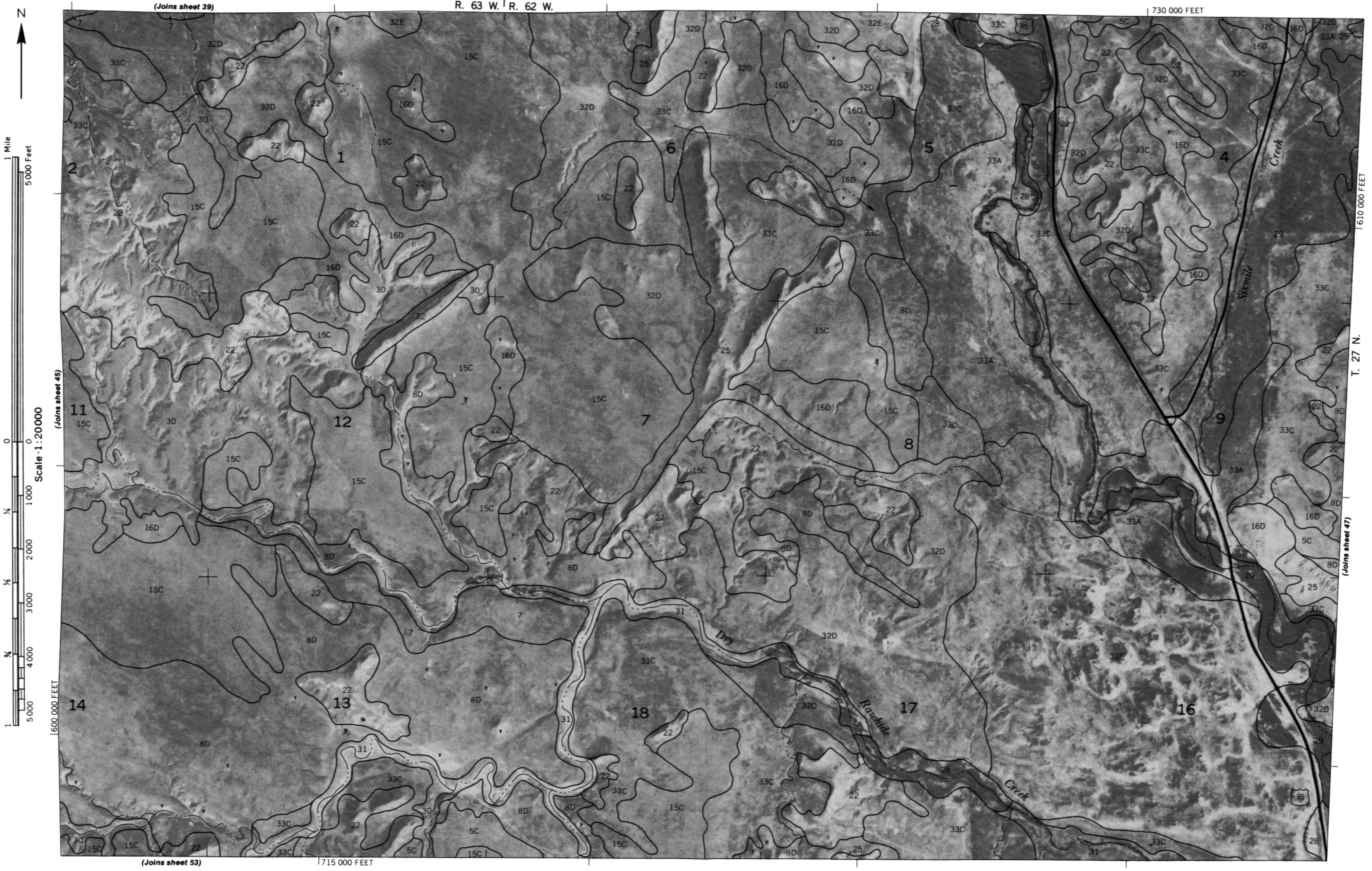


GOSHEN COUNTY, WYOMING, NORTH PART NO. 45

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

46

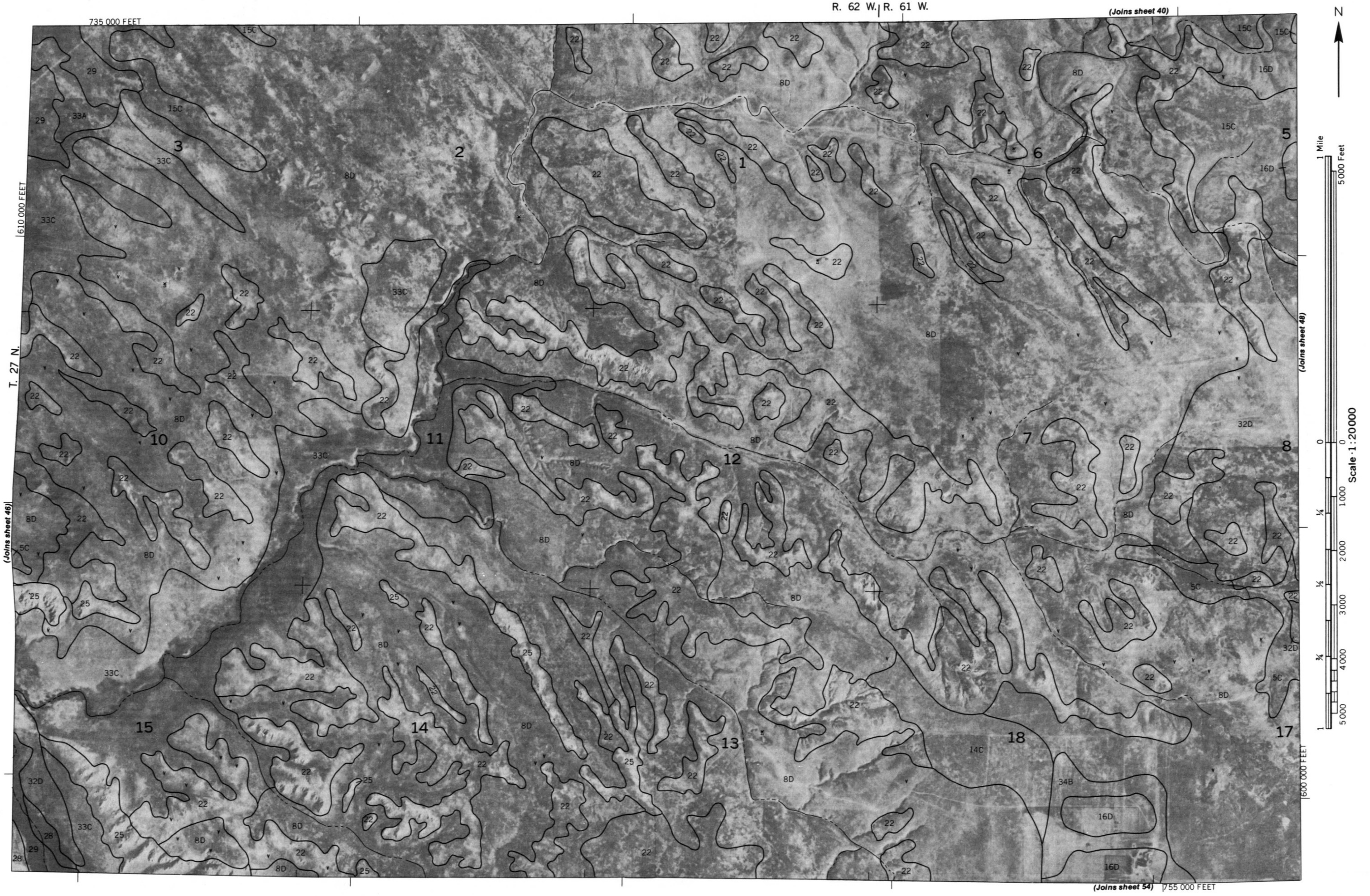
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 46



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 46

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 47



GOSHEN COUNTY, WYOMING, NORTH PART NO. 47

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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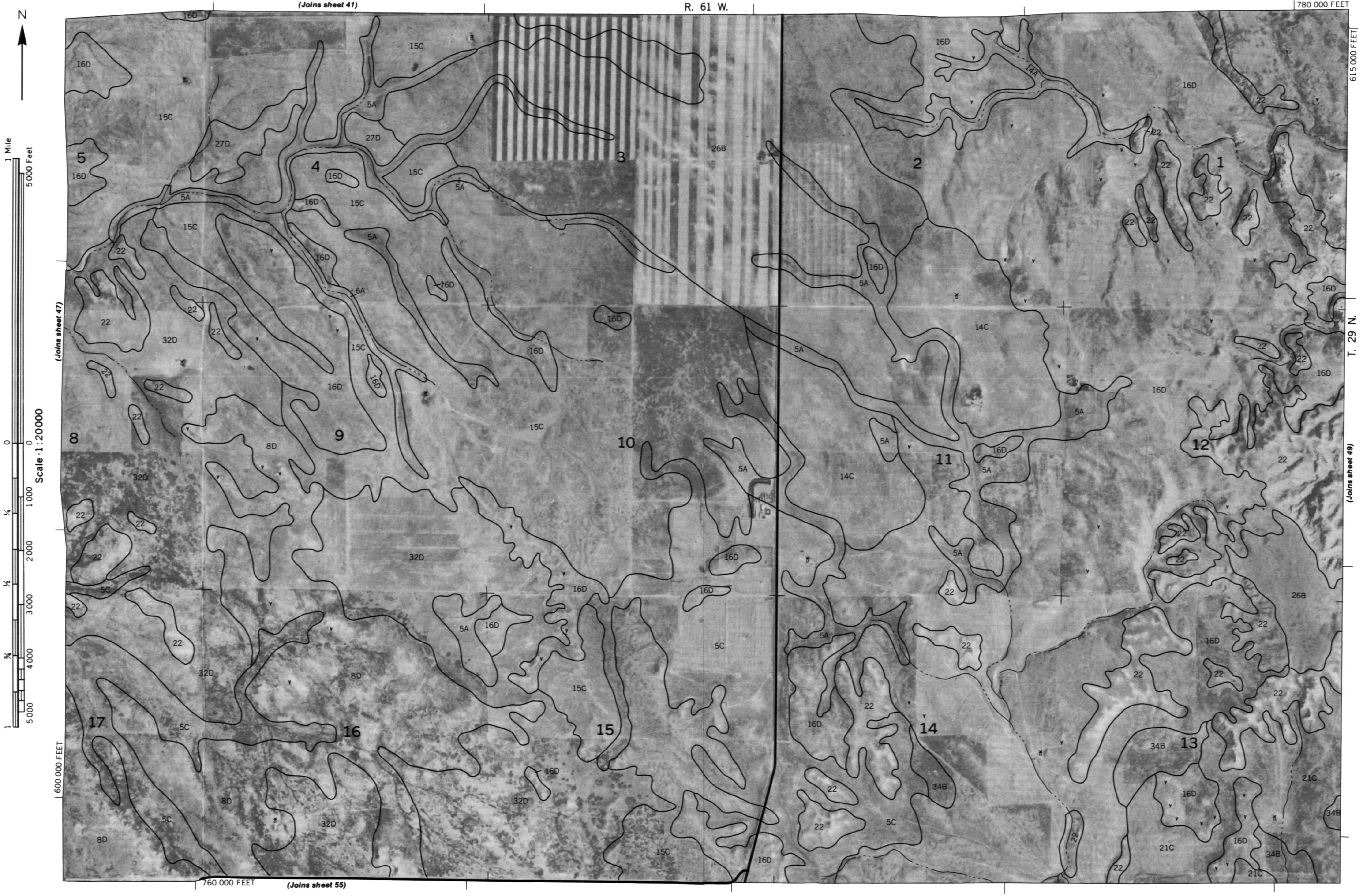
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 48



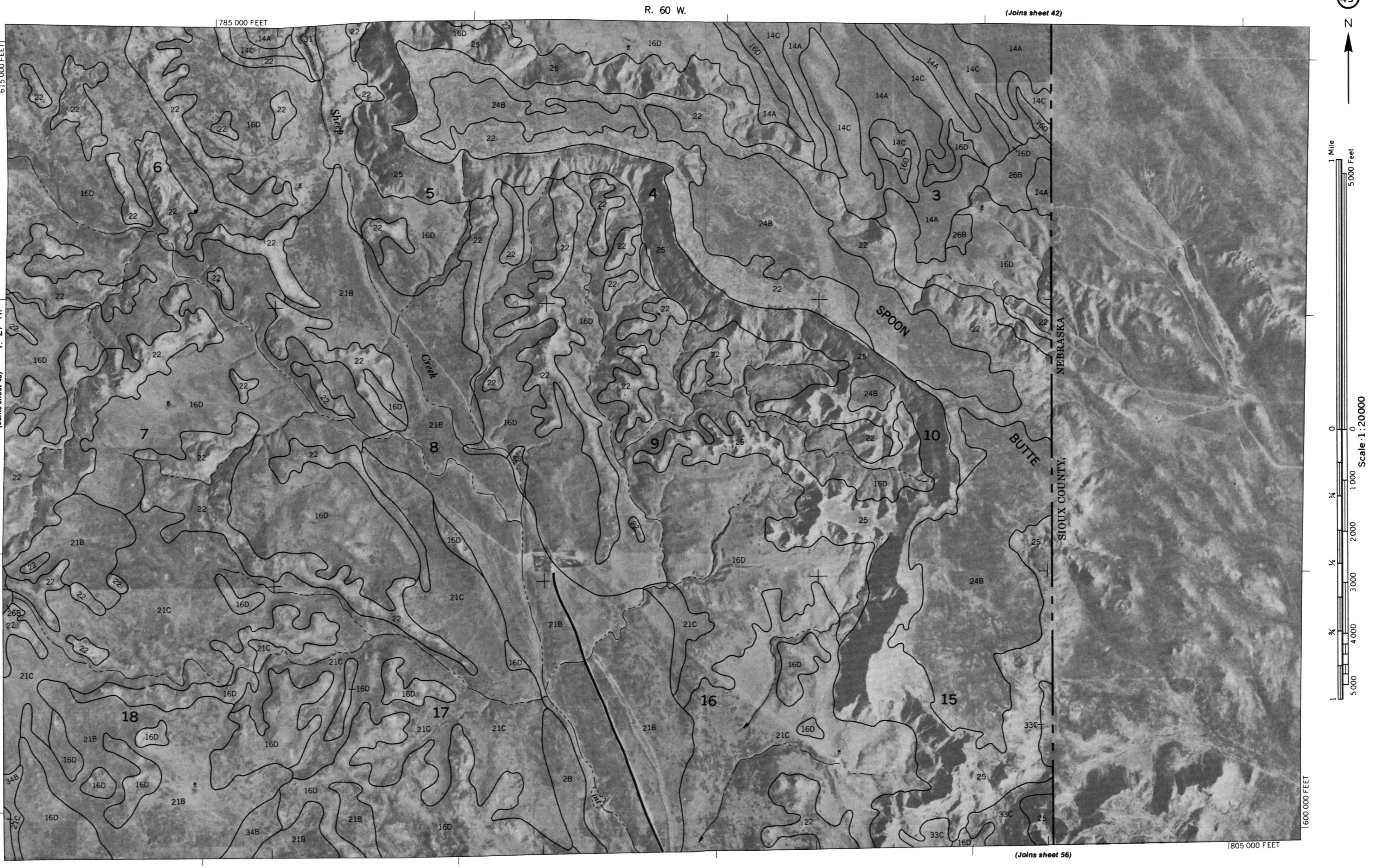
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 48

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 49

GOSHEN COUNTY, WYOMING, NORTH PART NO. 49

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



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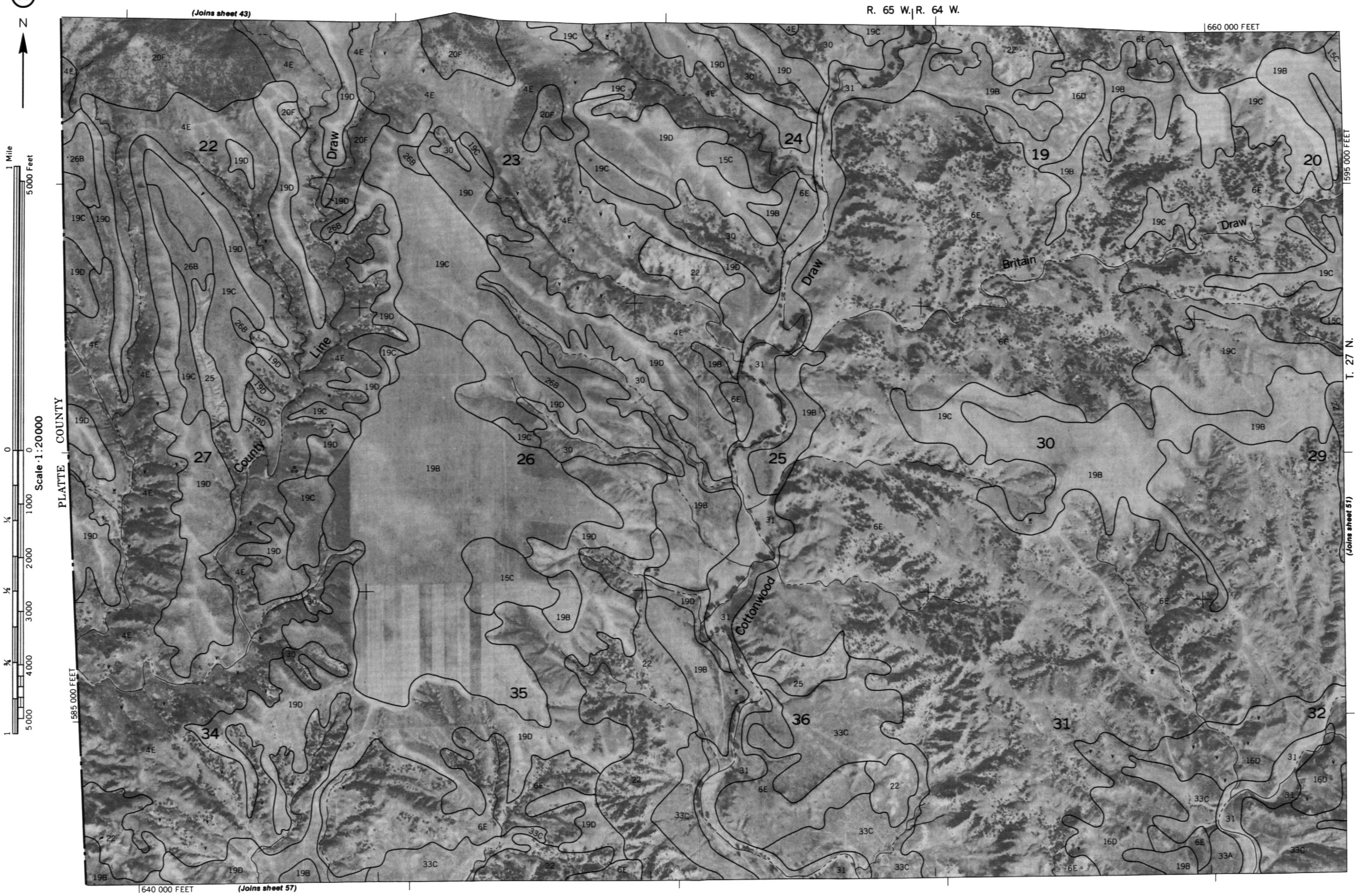
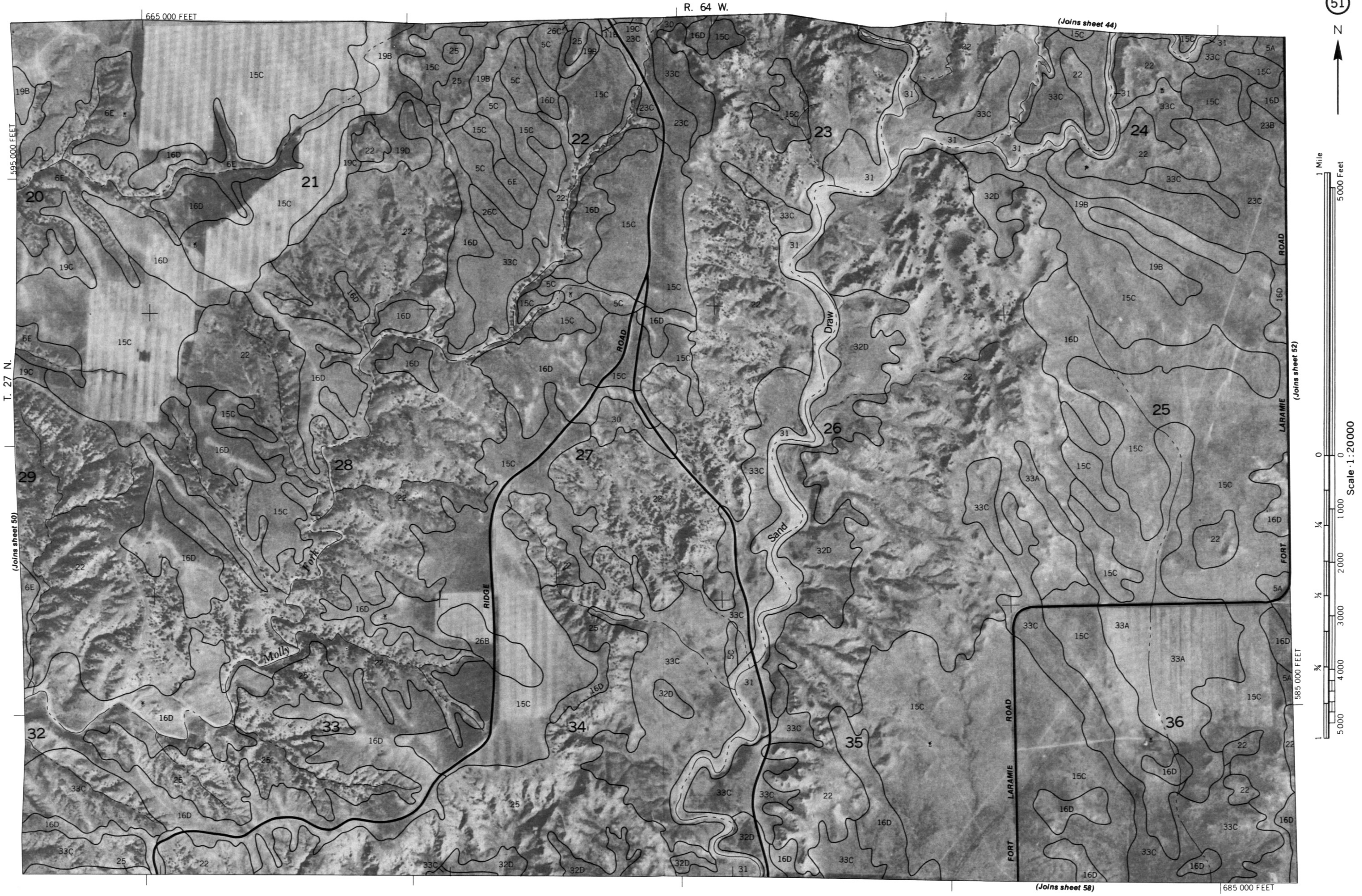
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 50



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 50

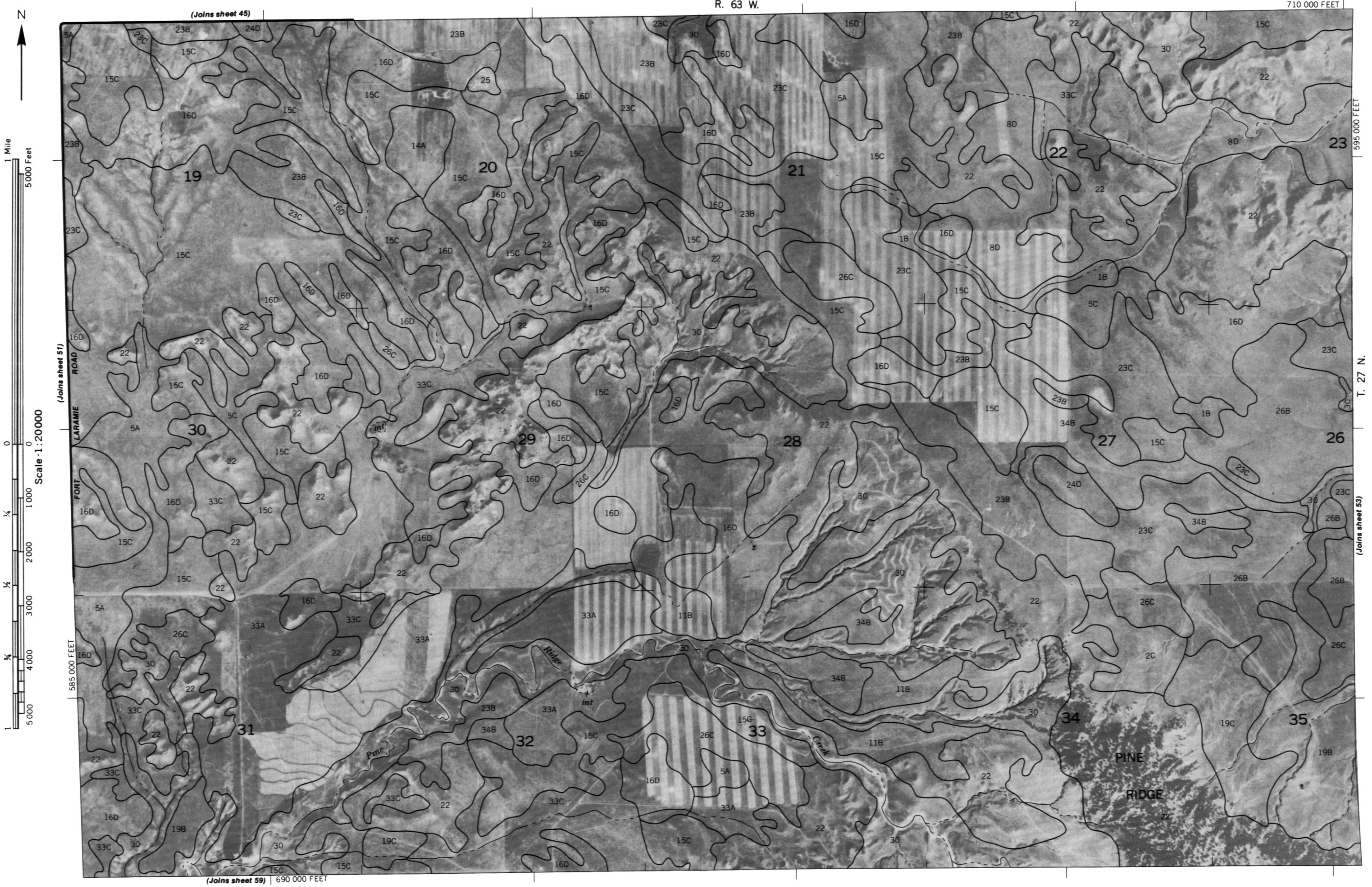
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 51



GOSHEN COUNTY, WYOMING, NORTH PART NO. 51

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

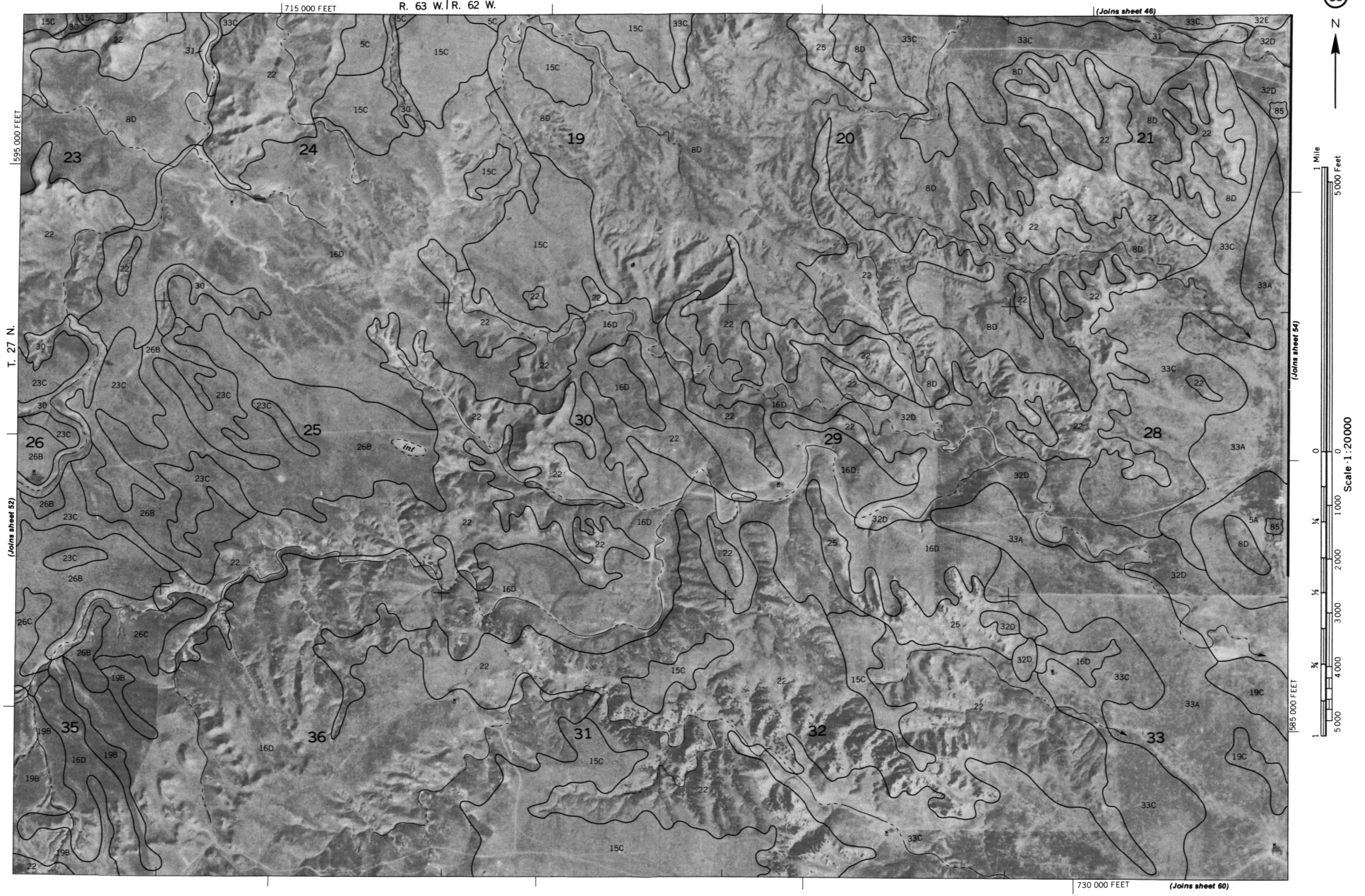
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 52



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 52

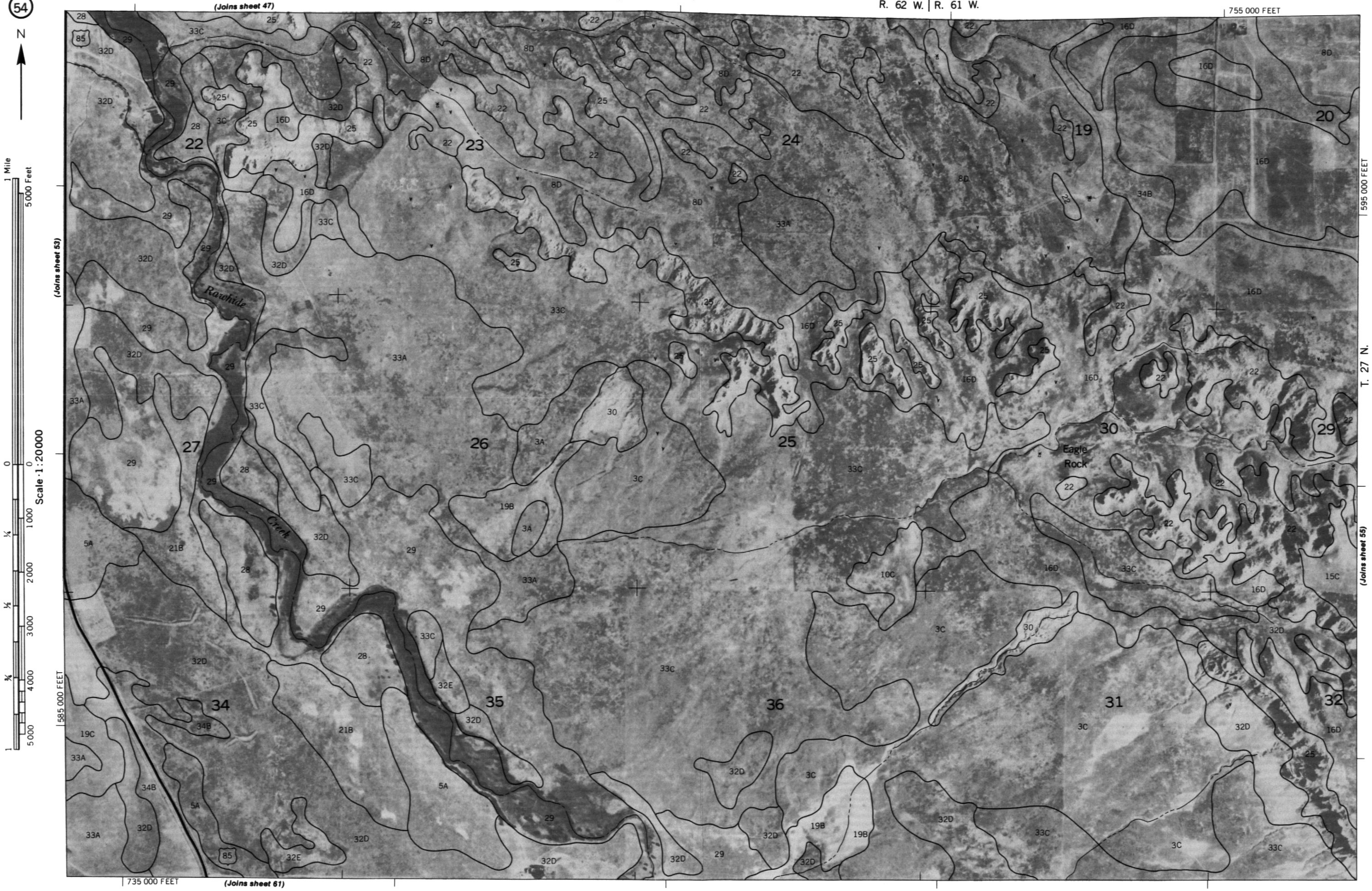
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 53



GOSHEN COUNTY, WYOMING, NORTH PART NO. 53

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

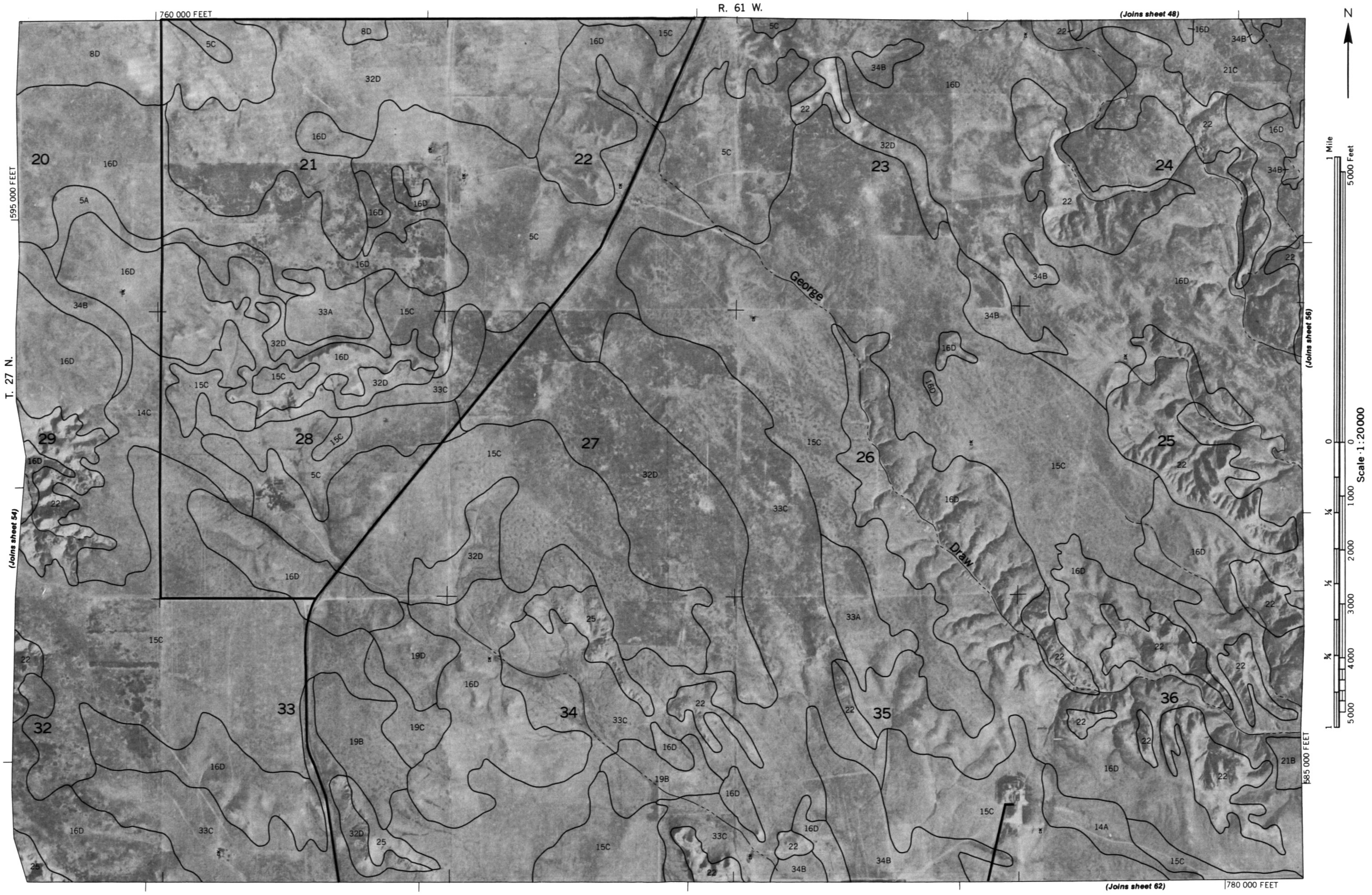
GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 54



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 54

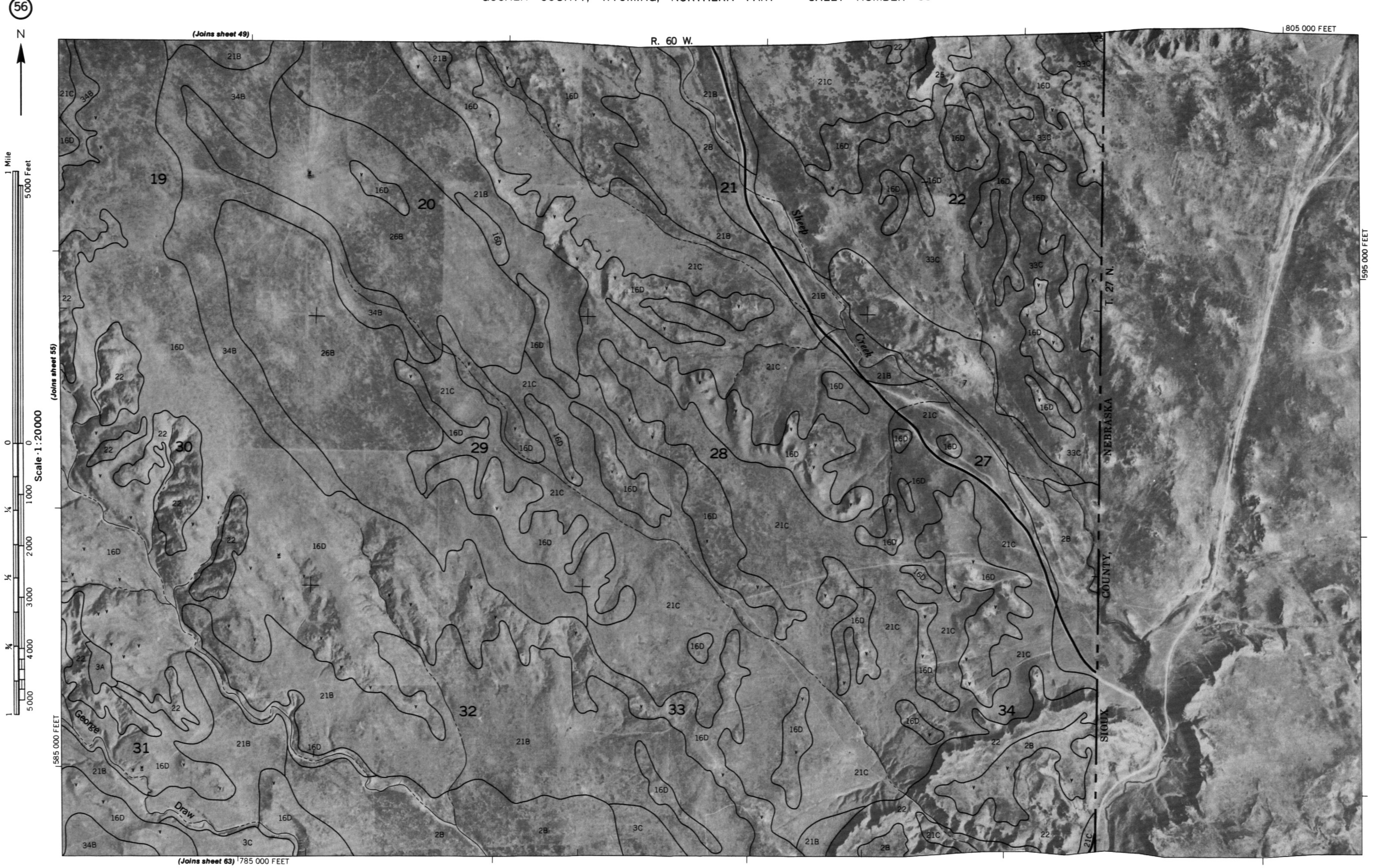
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 55



GOSHEN COUNTY, WYOMING, NORTH PART NO. 55

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

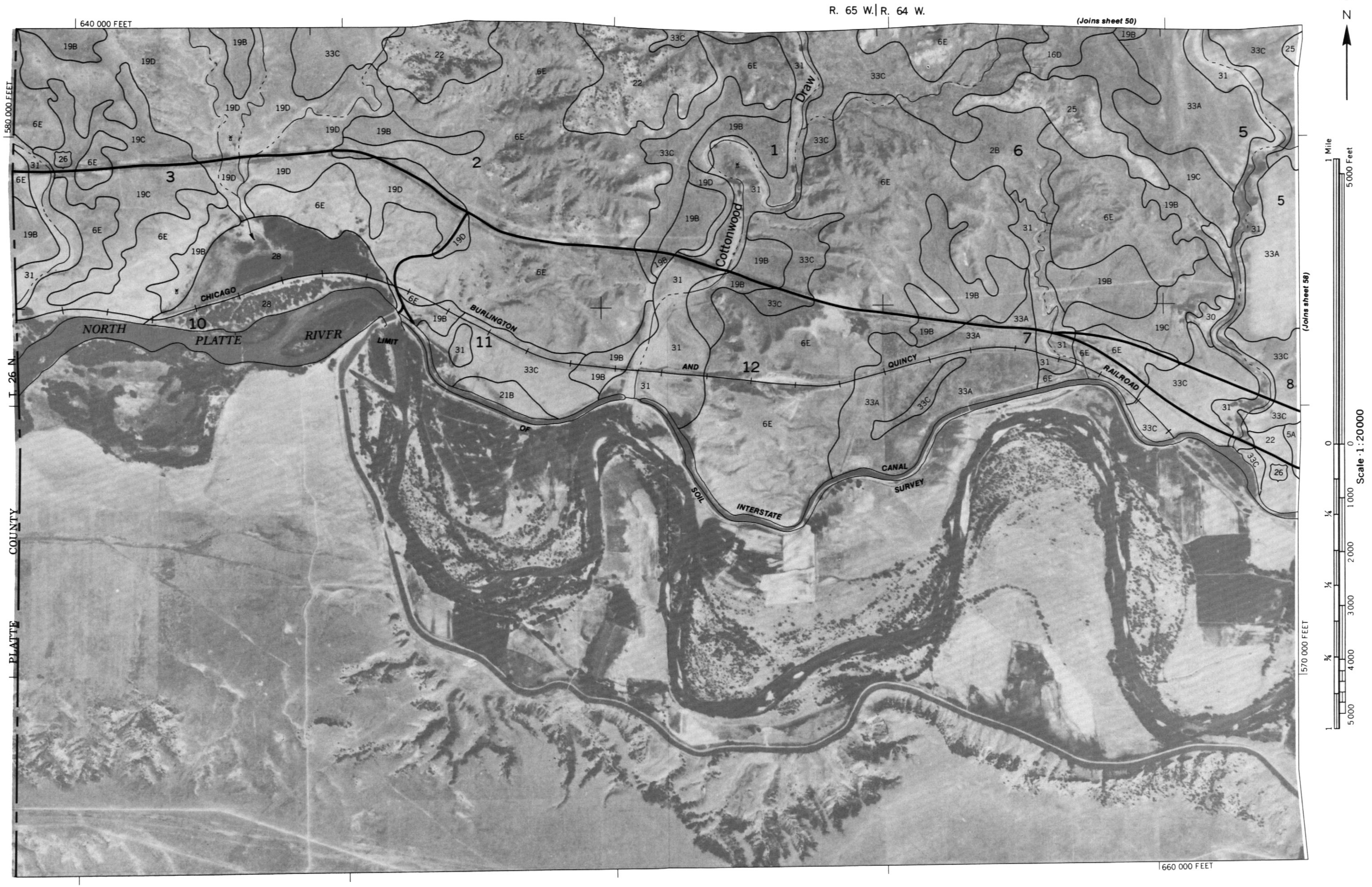
GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 56



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 56

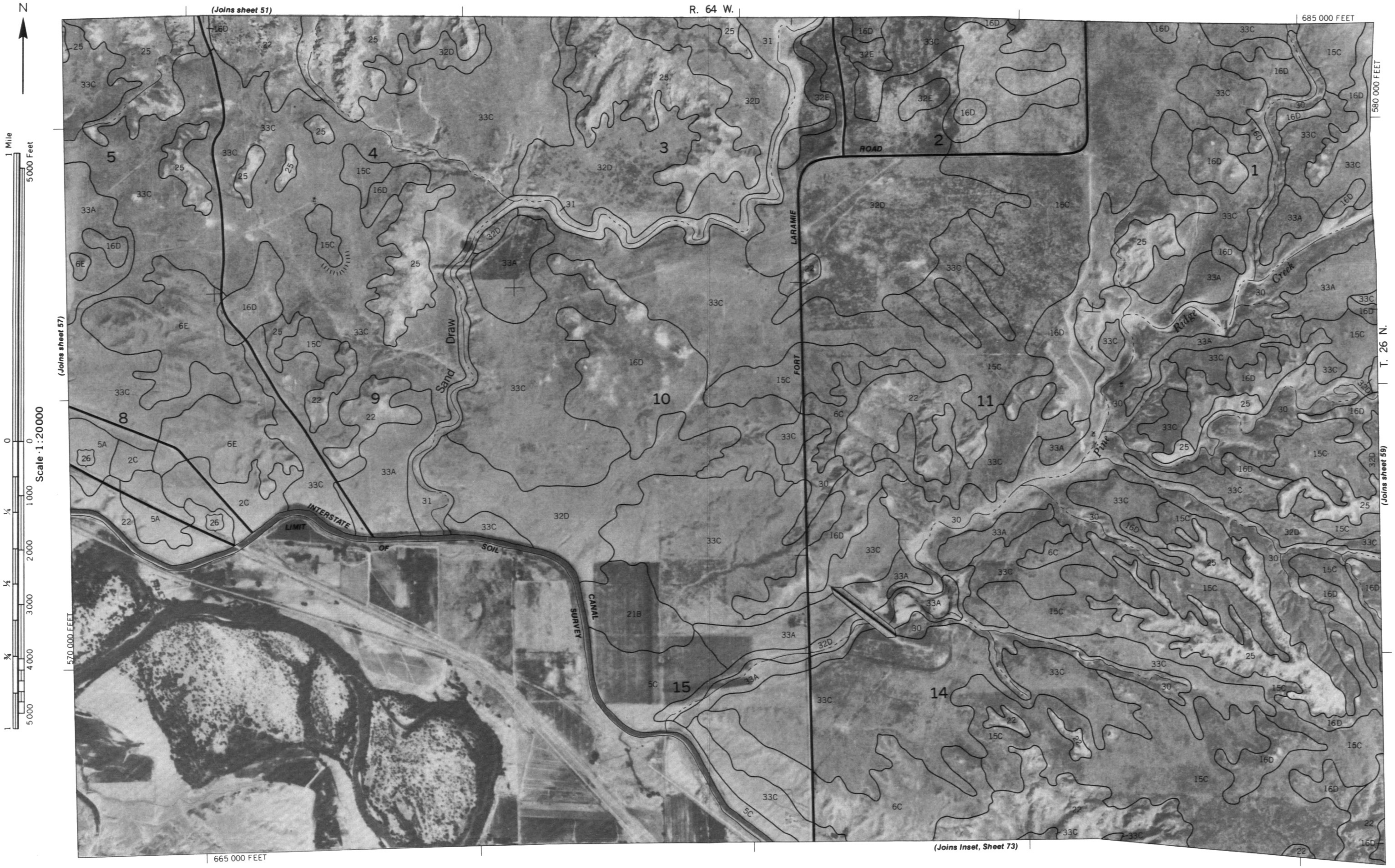
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 57



GOSHEN COUNTY, WYOMING, NORTH PART NO. 57

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 58



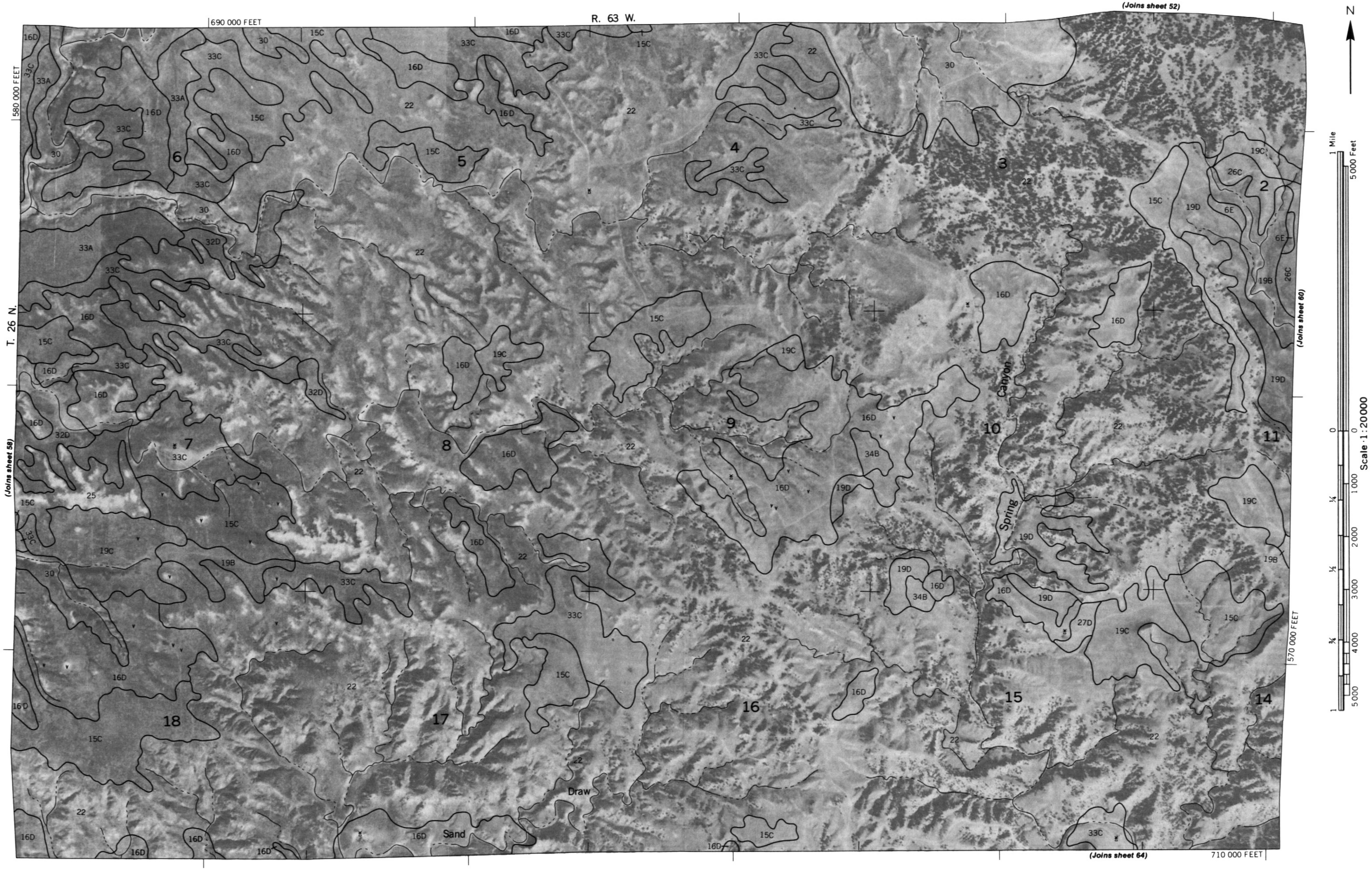
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 58

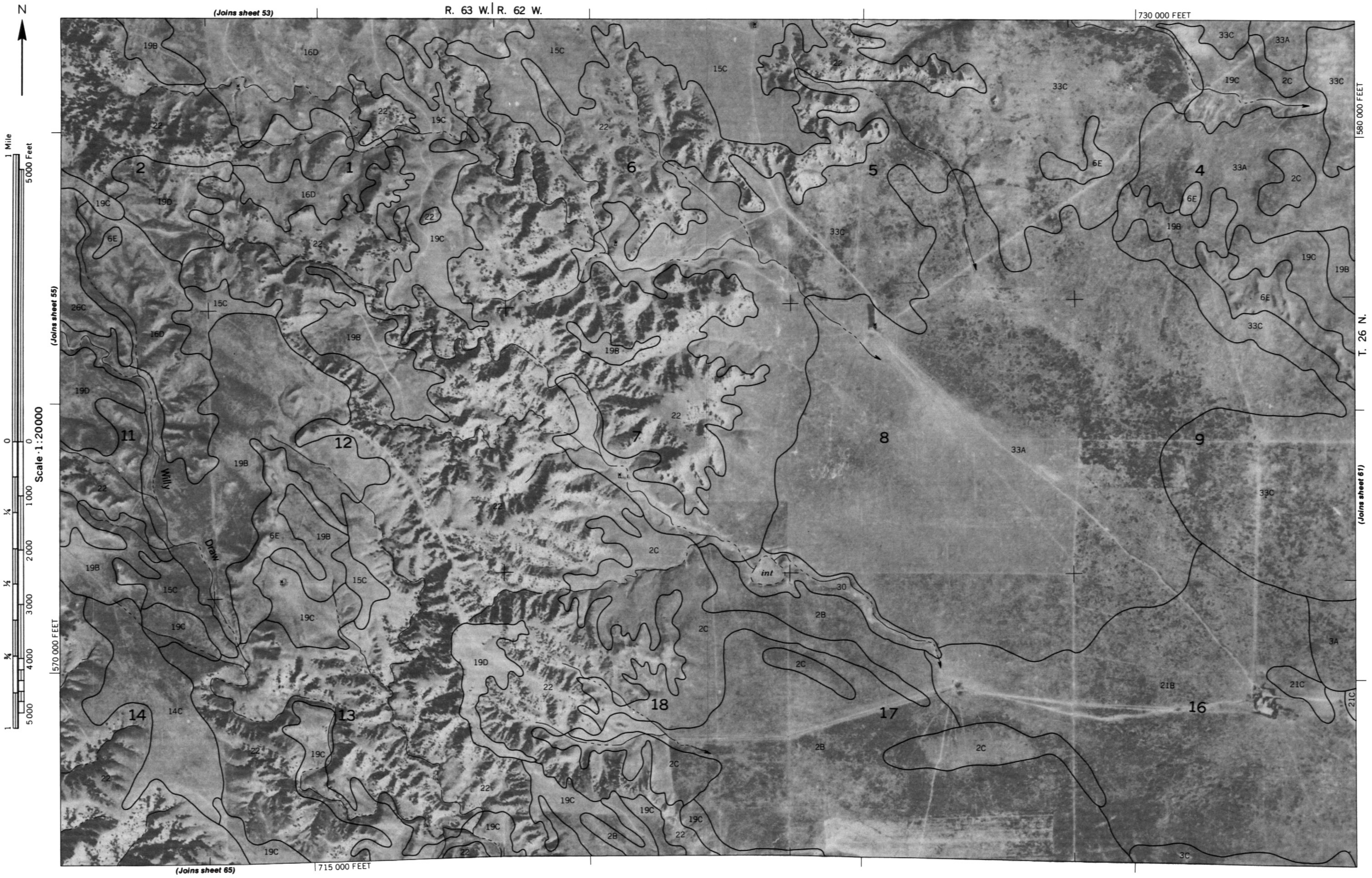
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 59

GOSHEN COUNTY, WYOMING, NORTH PART NO. 59

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

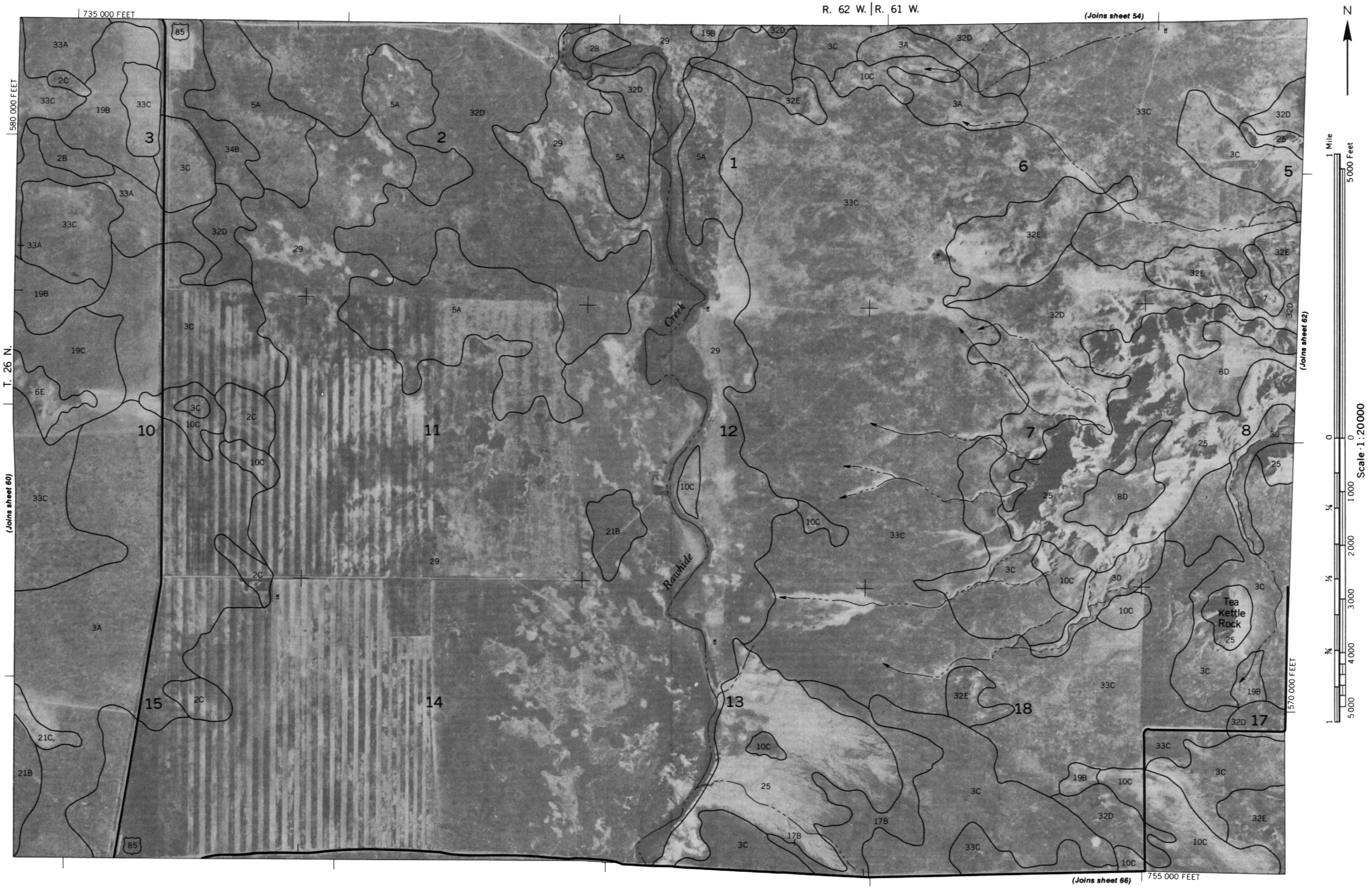


GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 60



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

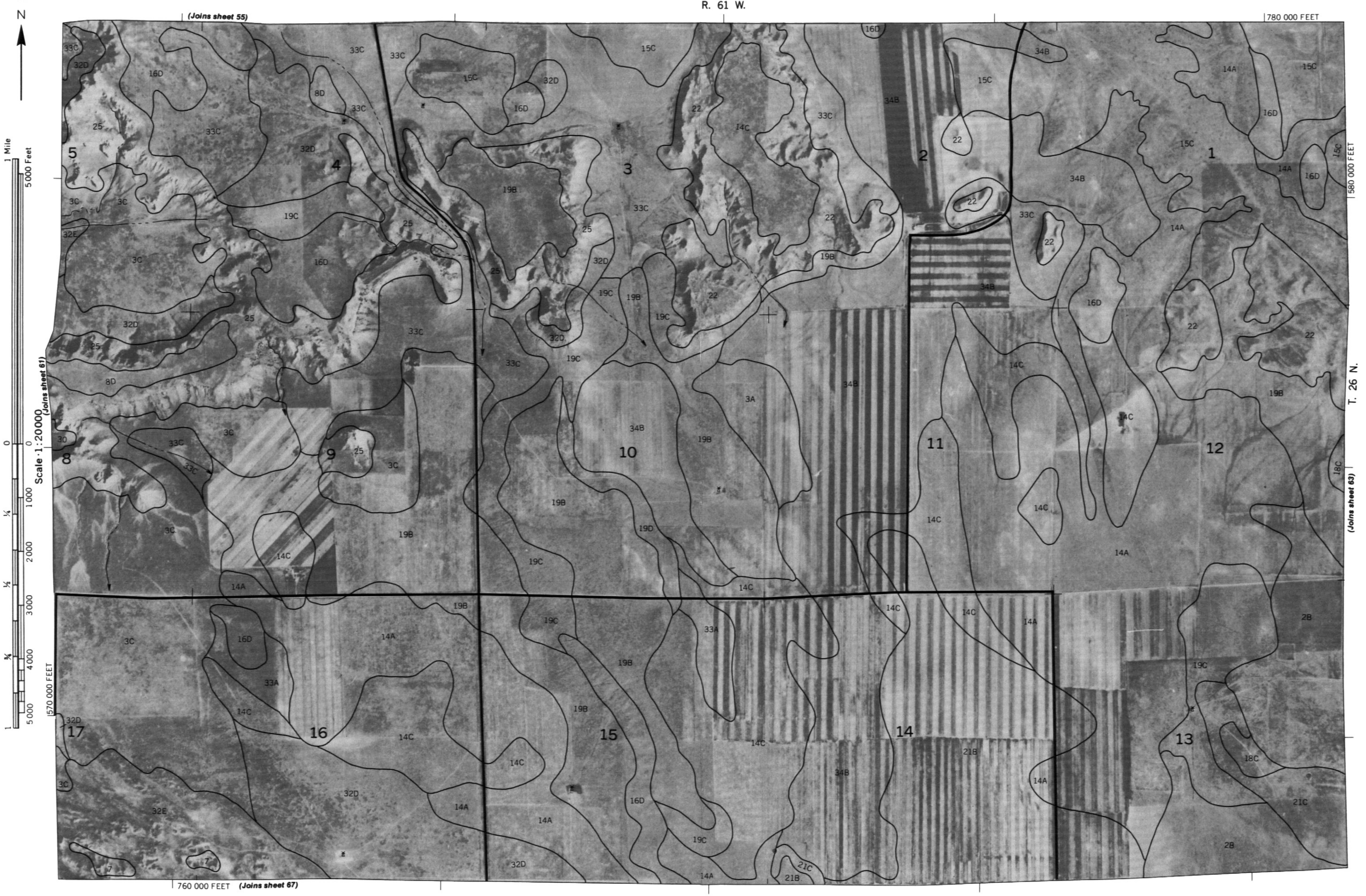
GOSHEN COUNTY, WYOMING, NORTH PART NO. 60



GOSHEN COUNTY, WYOMING, NORTH PART NO. 61

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 62



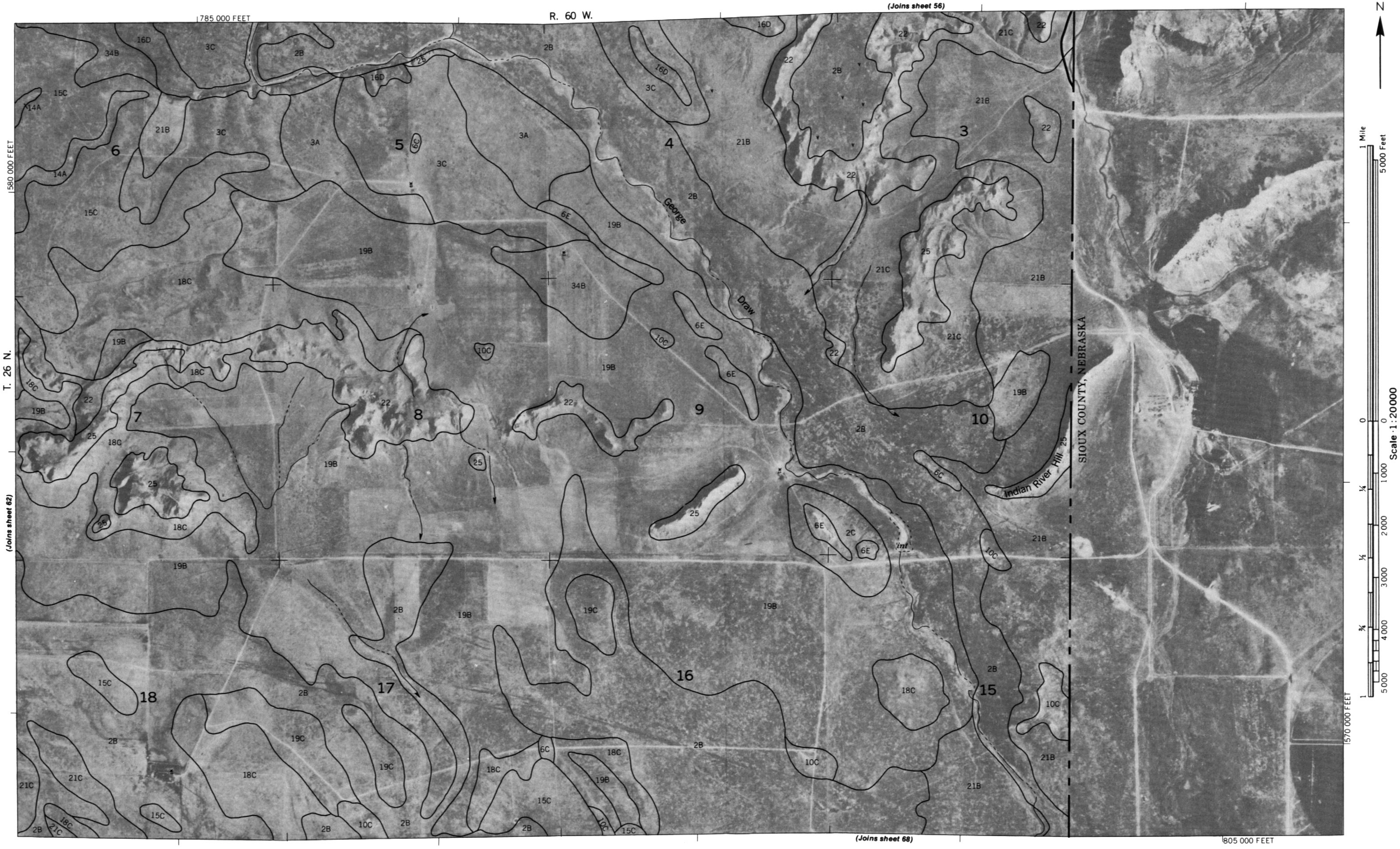
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 62

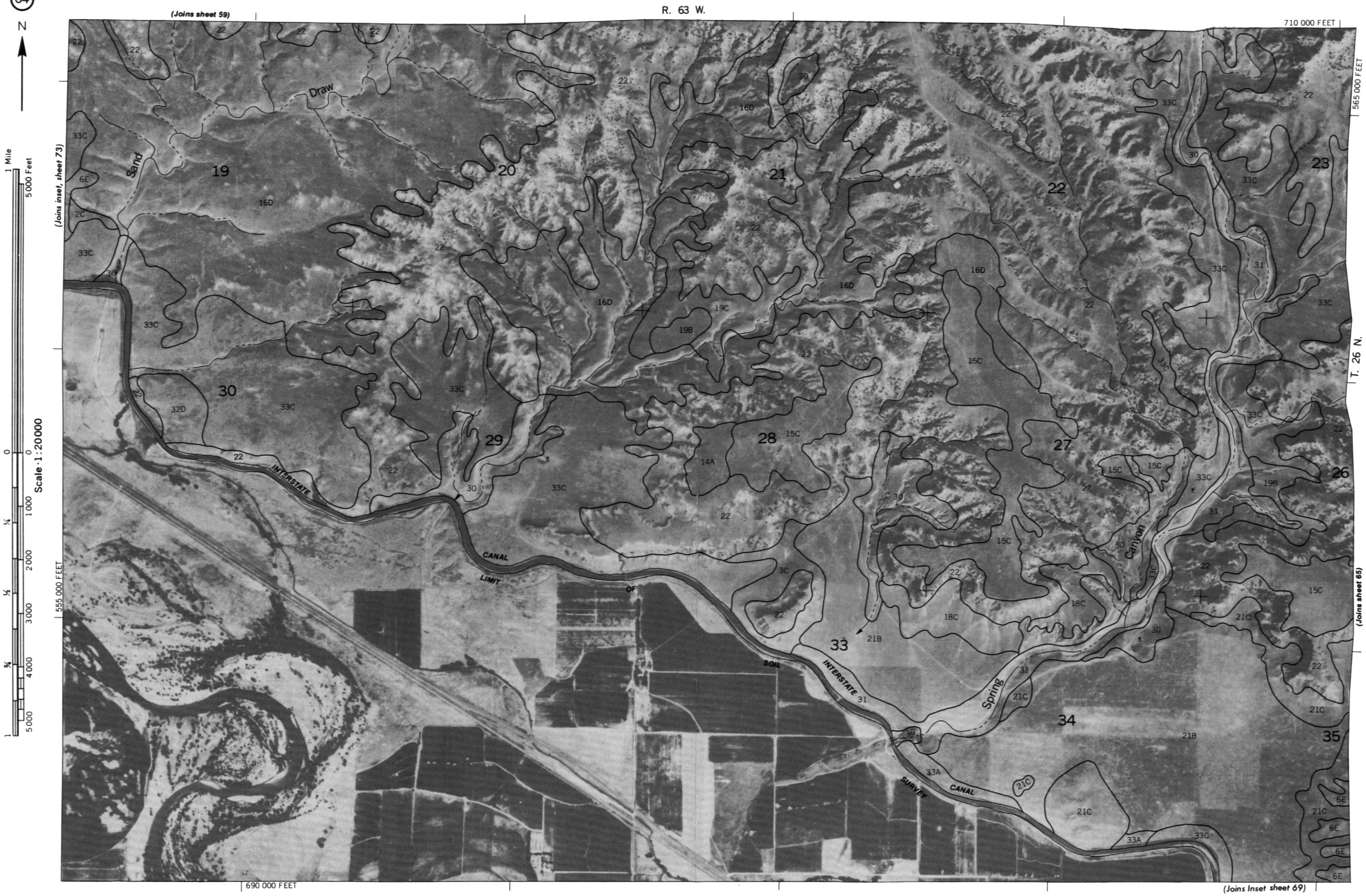
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 63

GOSHEN COUNTY, WYOMING, NORTH PART NO. 63

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.



GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 64

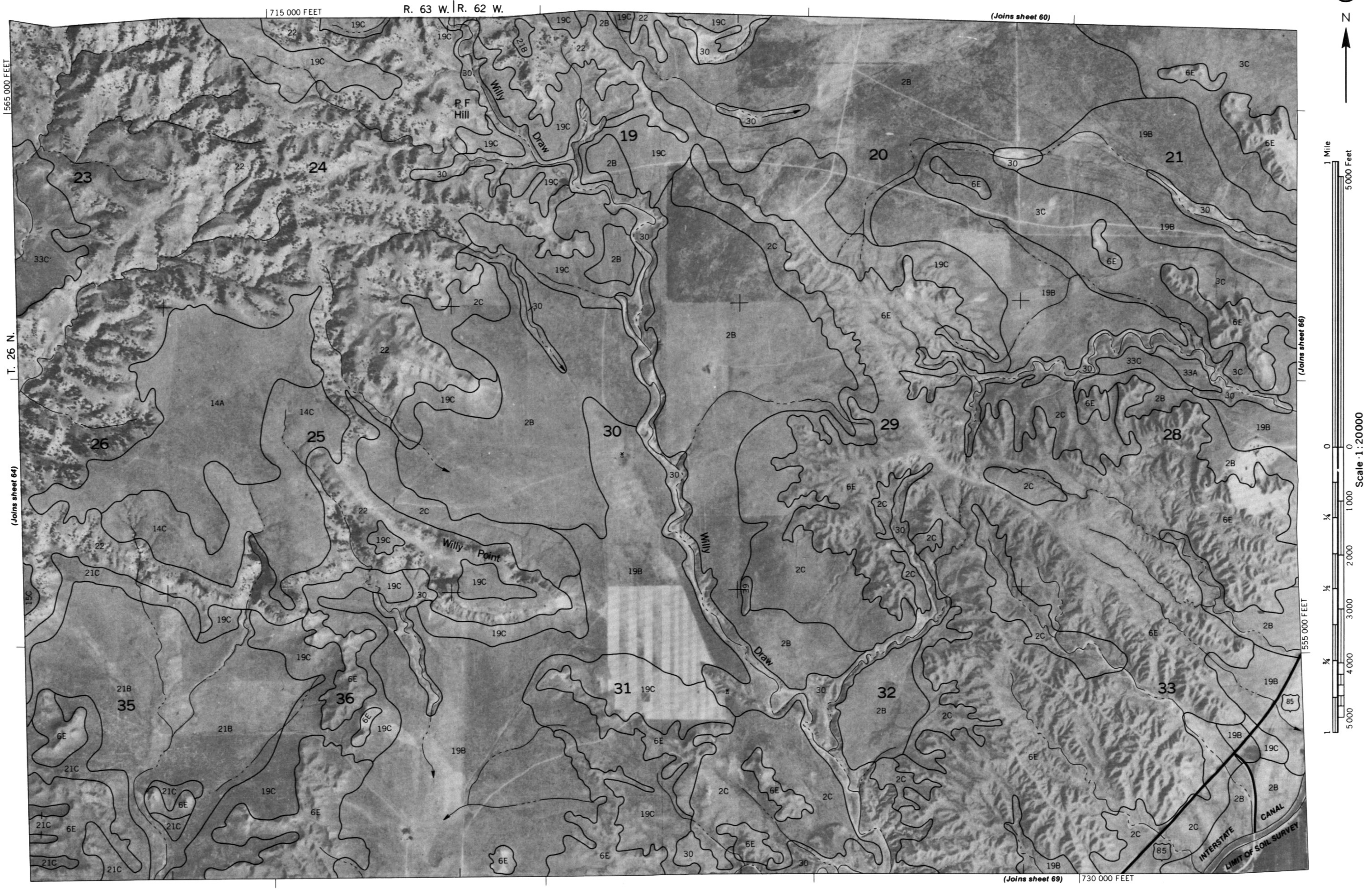


This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 64

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 65

(65)



GOSHEN COUNTY, WYOMING, NORTH PART NO. 65

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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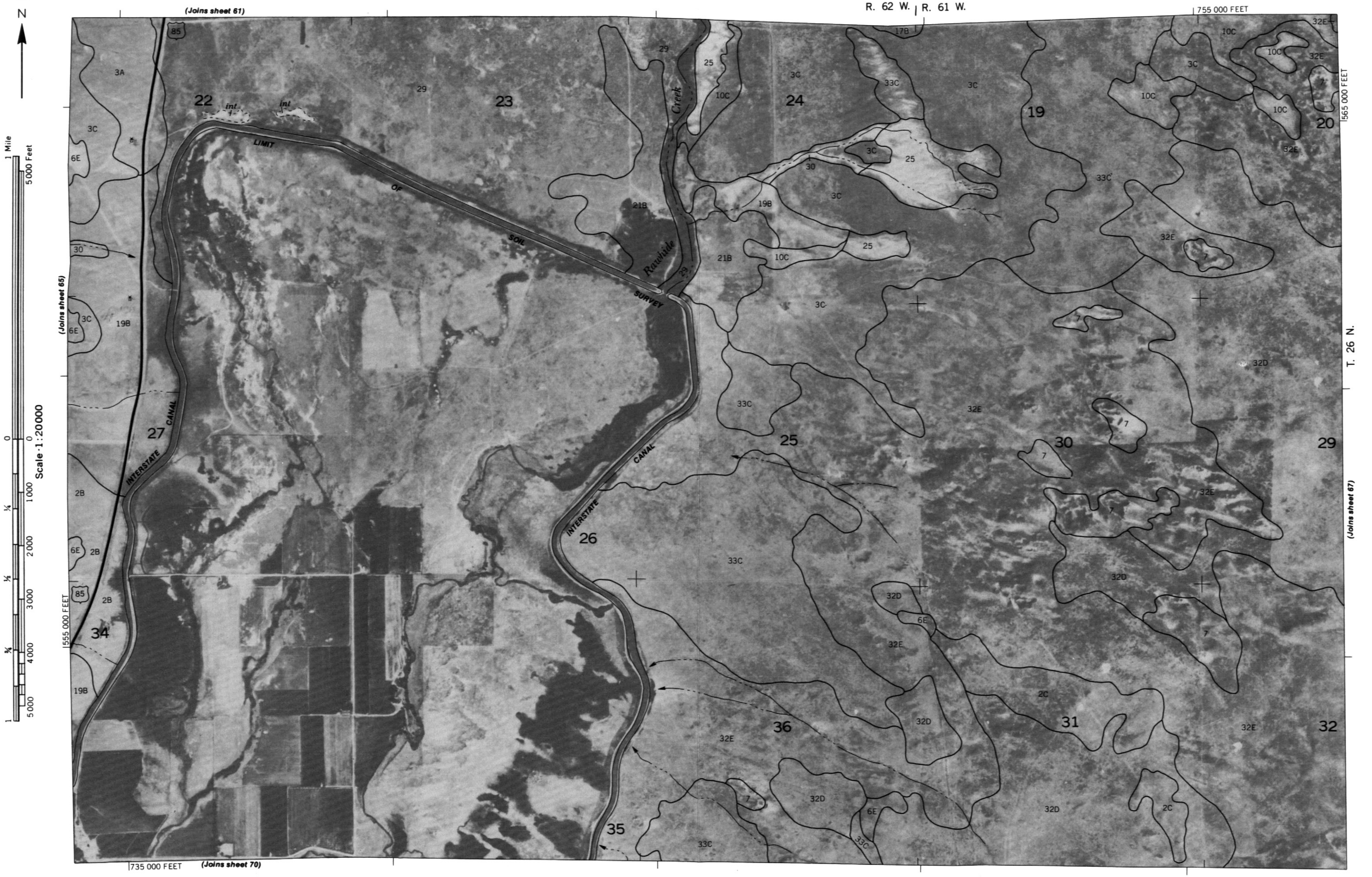
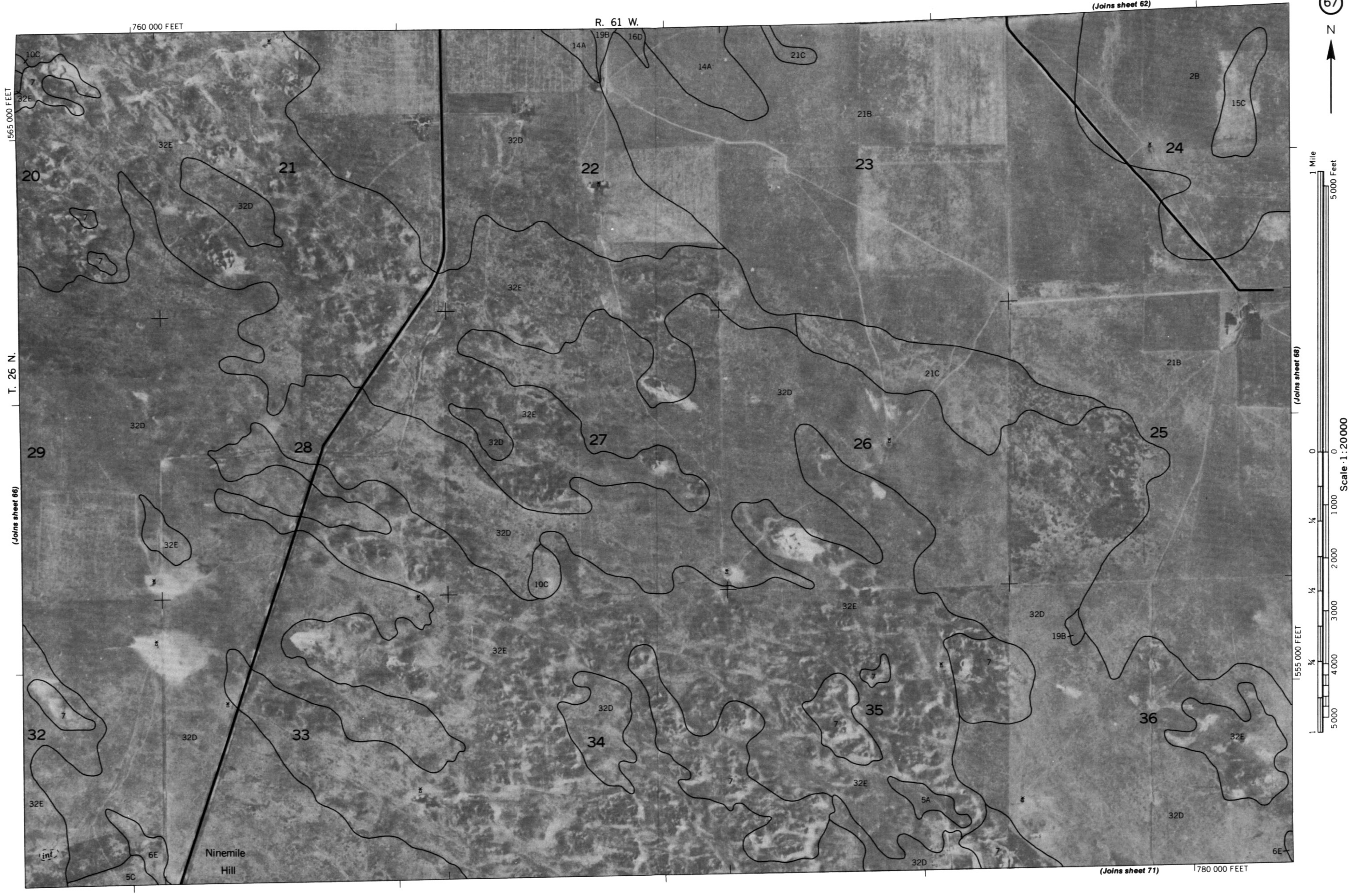
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 66



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 66

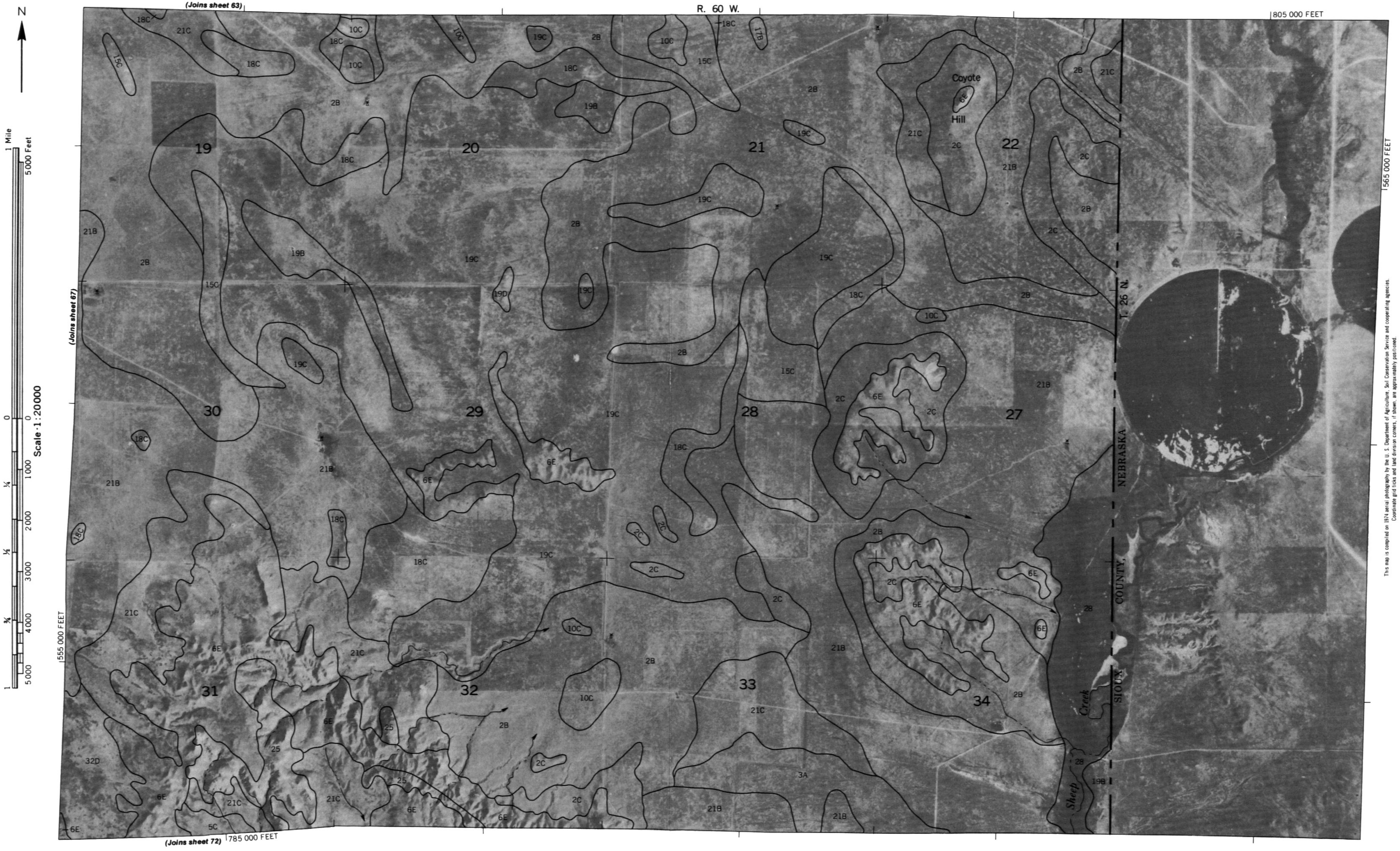
GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 67



GOSHEN COUNTY, WYOMING, NORTH PART NO. 67

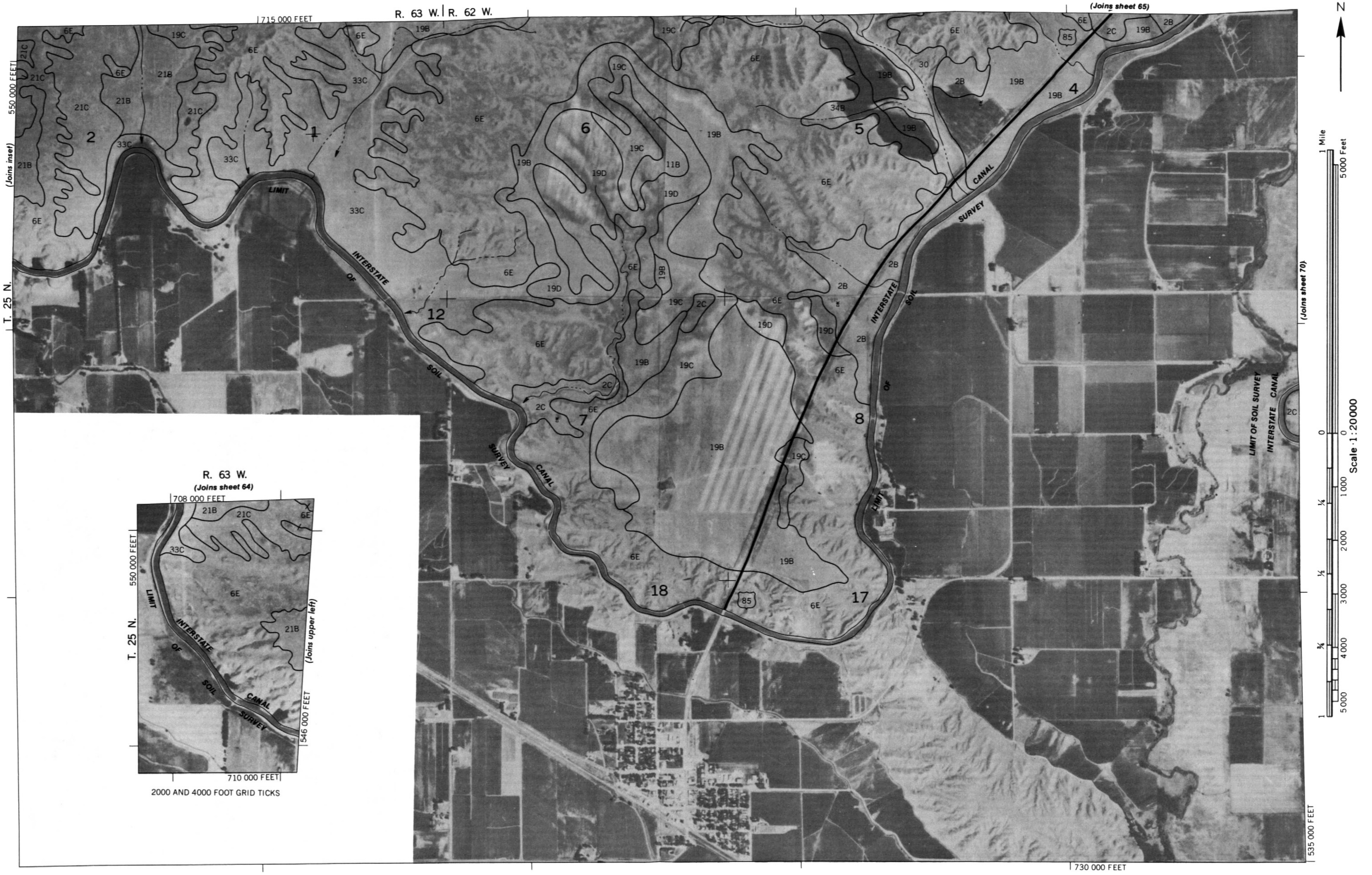
This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 68



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 69

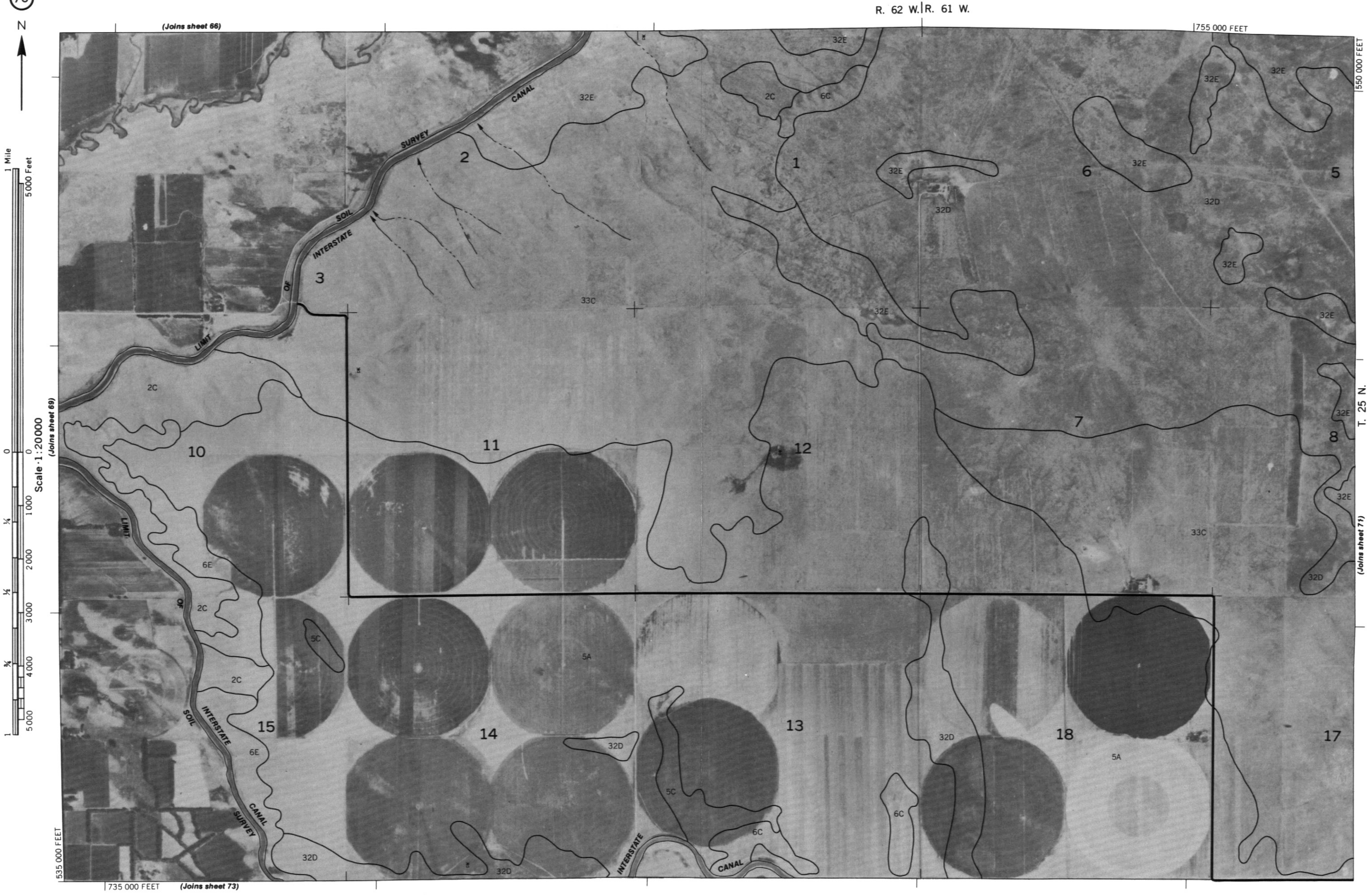


GOSHEN COUNTY, WYOMING, NORTH PART NO. 69

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

70

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 70



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

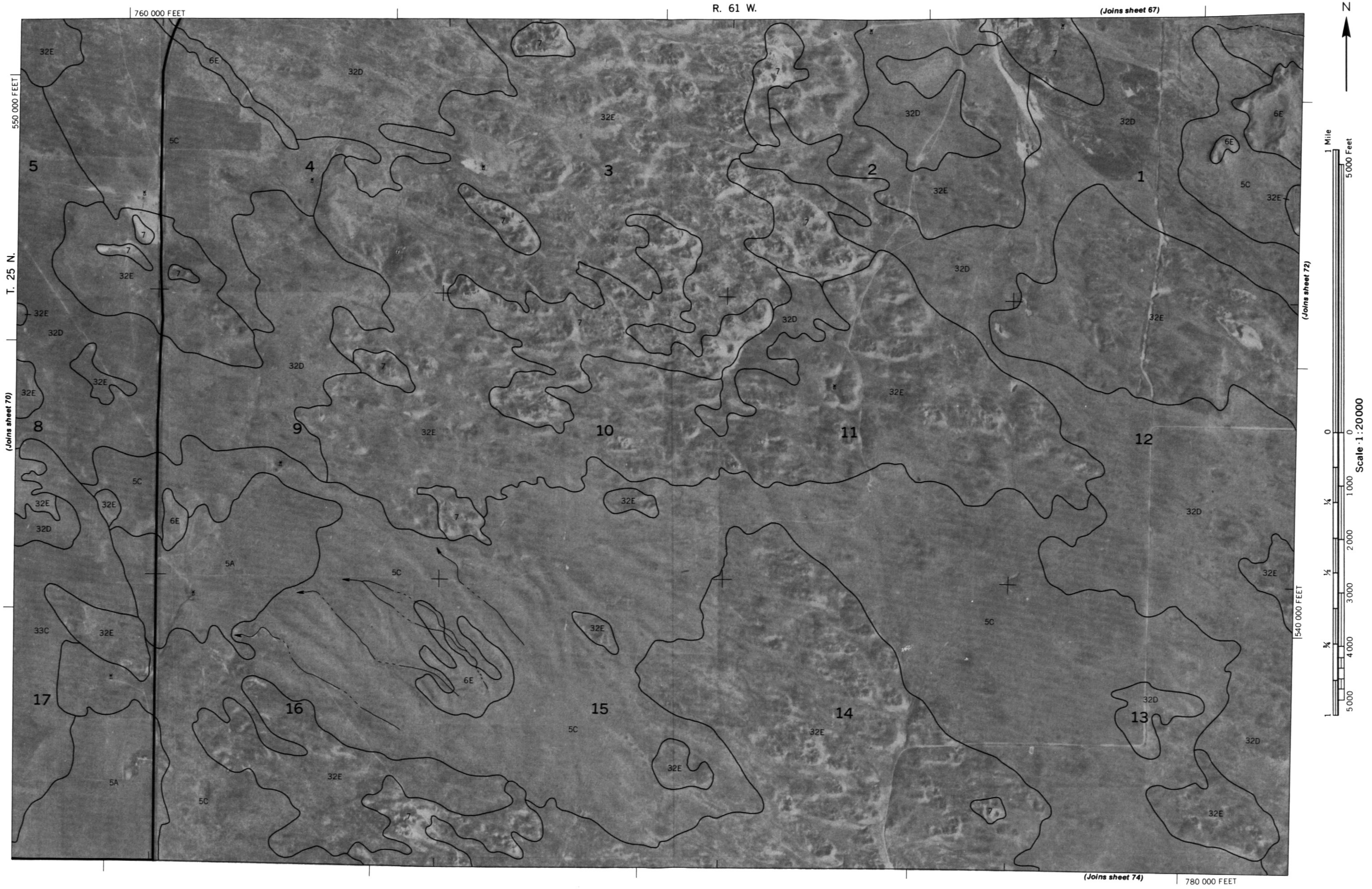
GOSHEN COUNTY, WYOMING, NORTH PART NO. 70

GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 71

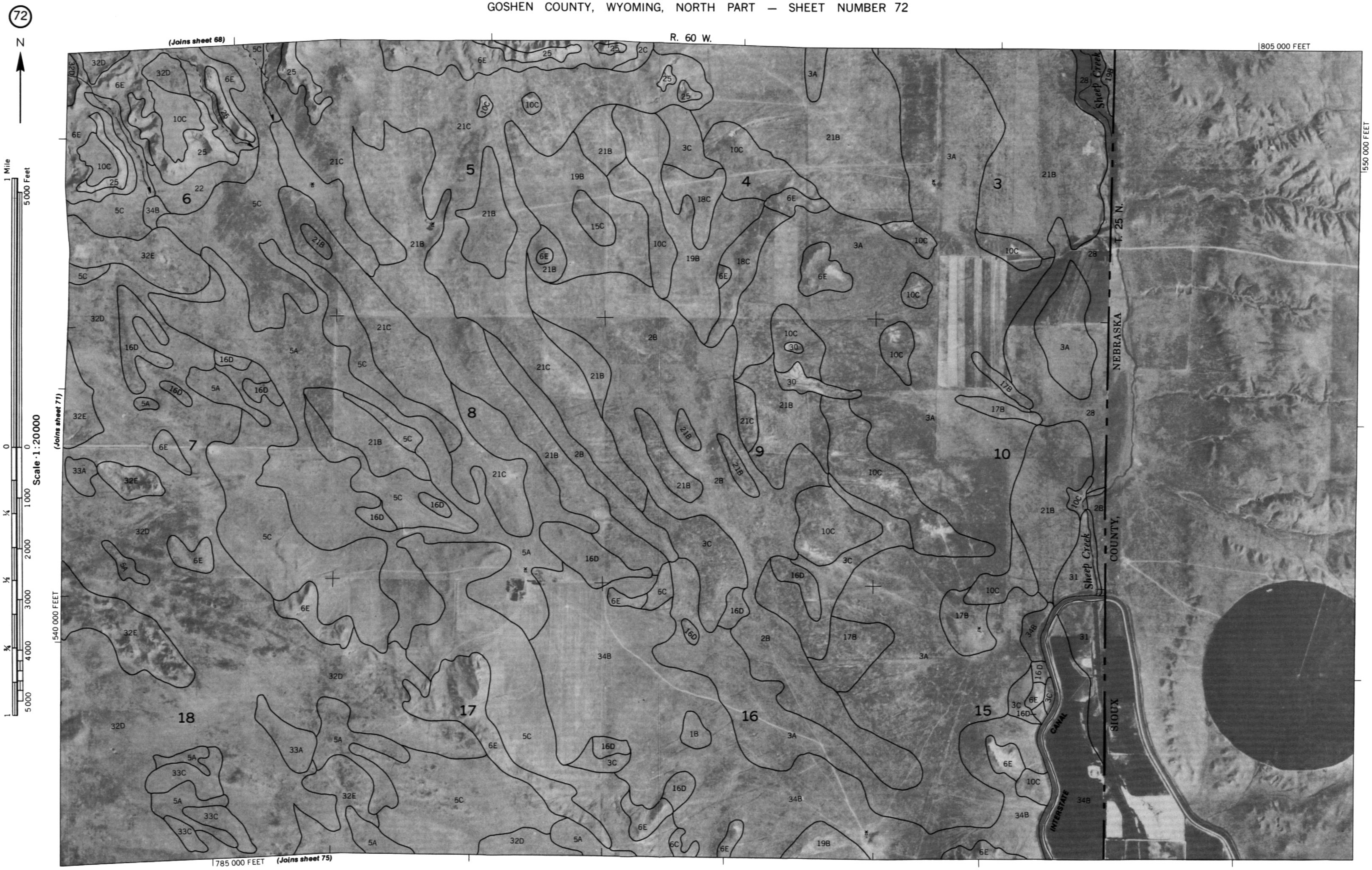
(71)

GOSHEN COUNTY, WYOMING, NORTH PART NO. 71

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.



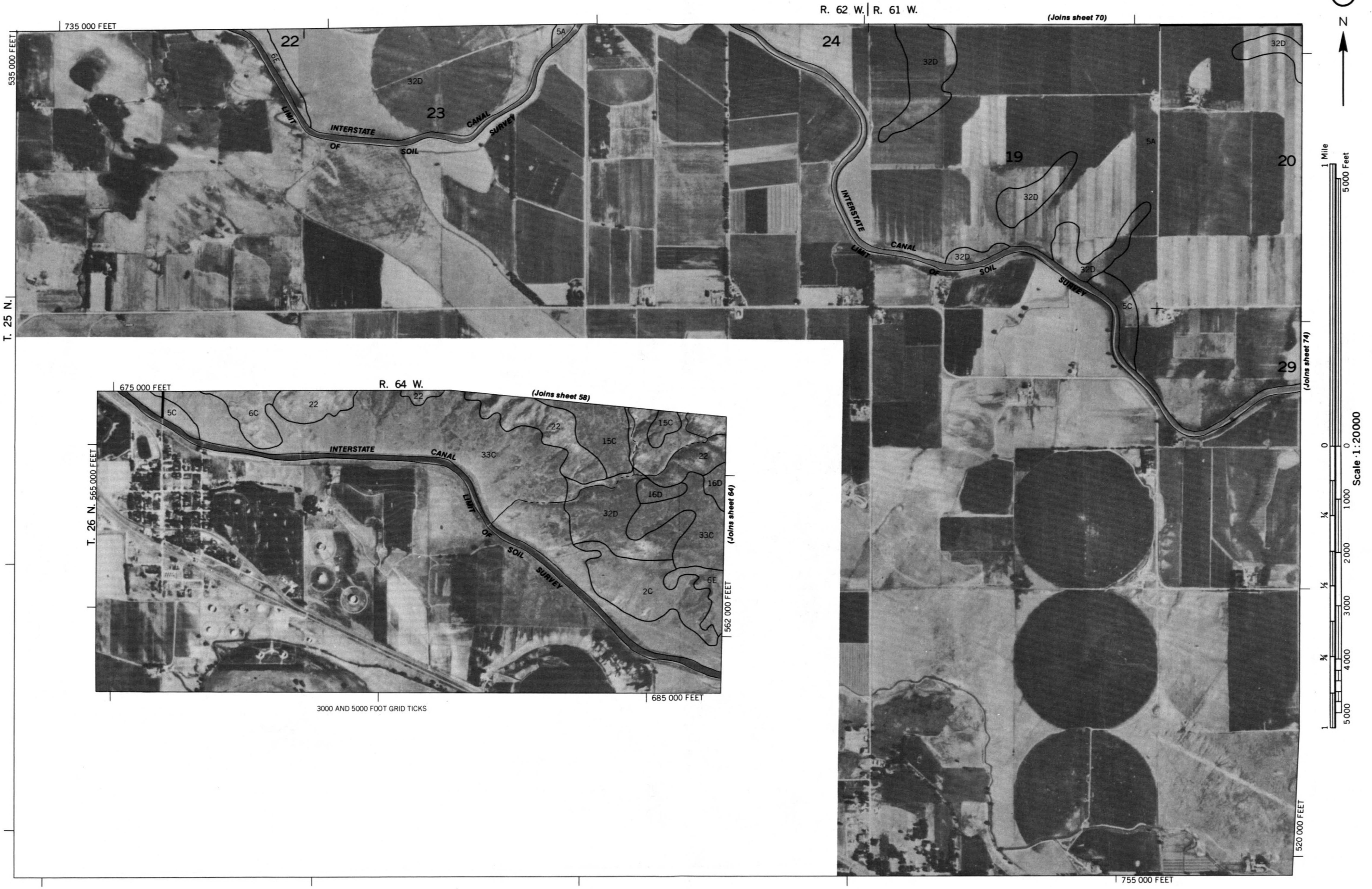
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 72



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 72

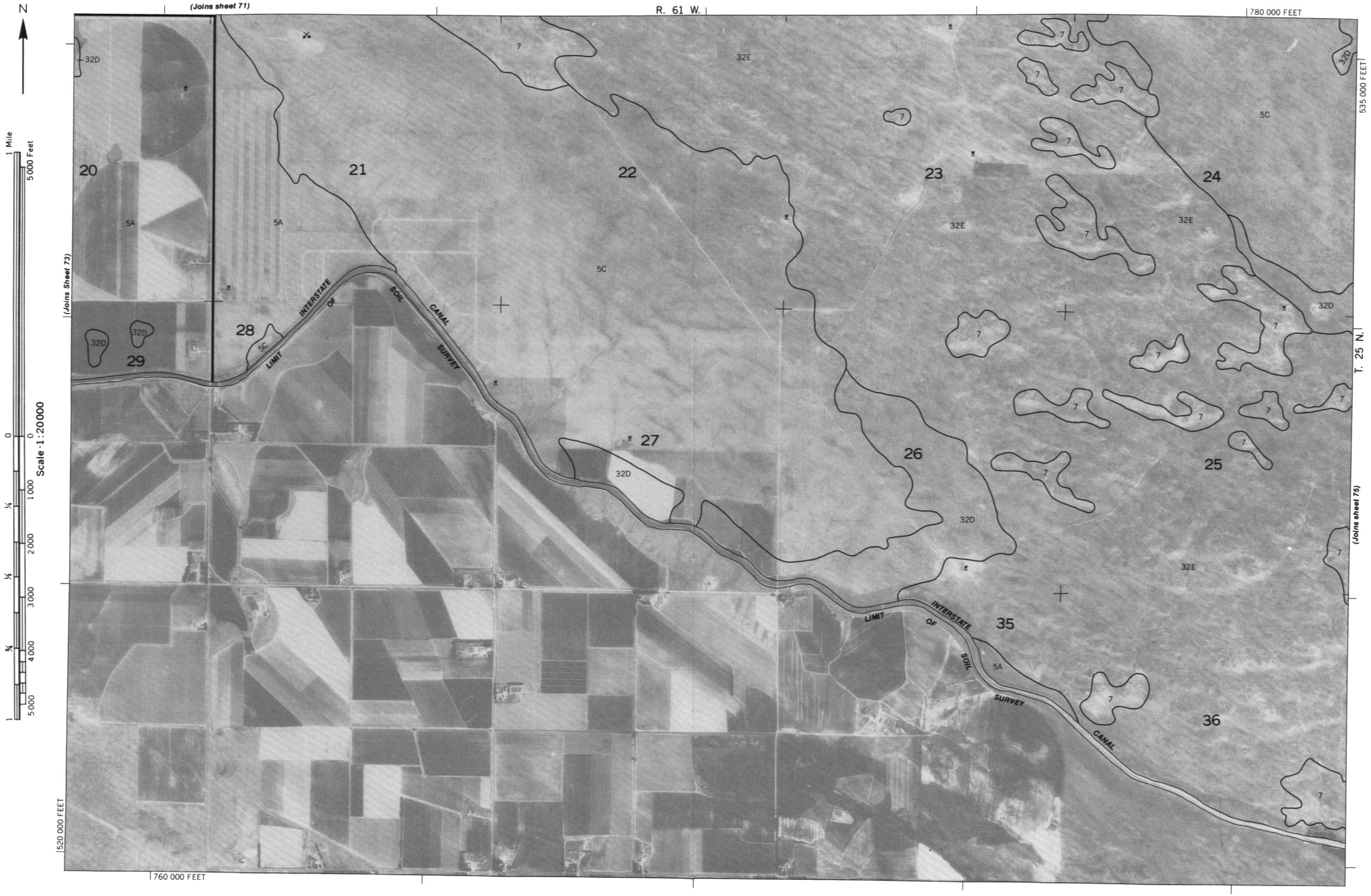
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 73



GOSHEN COUNTY, WYOMING, NORTH PART NO. 73

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

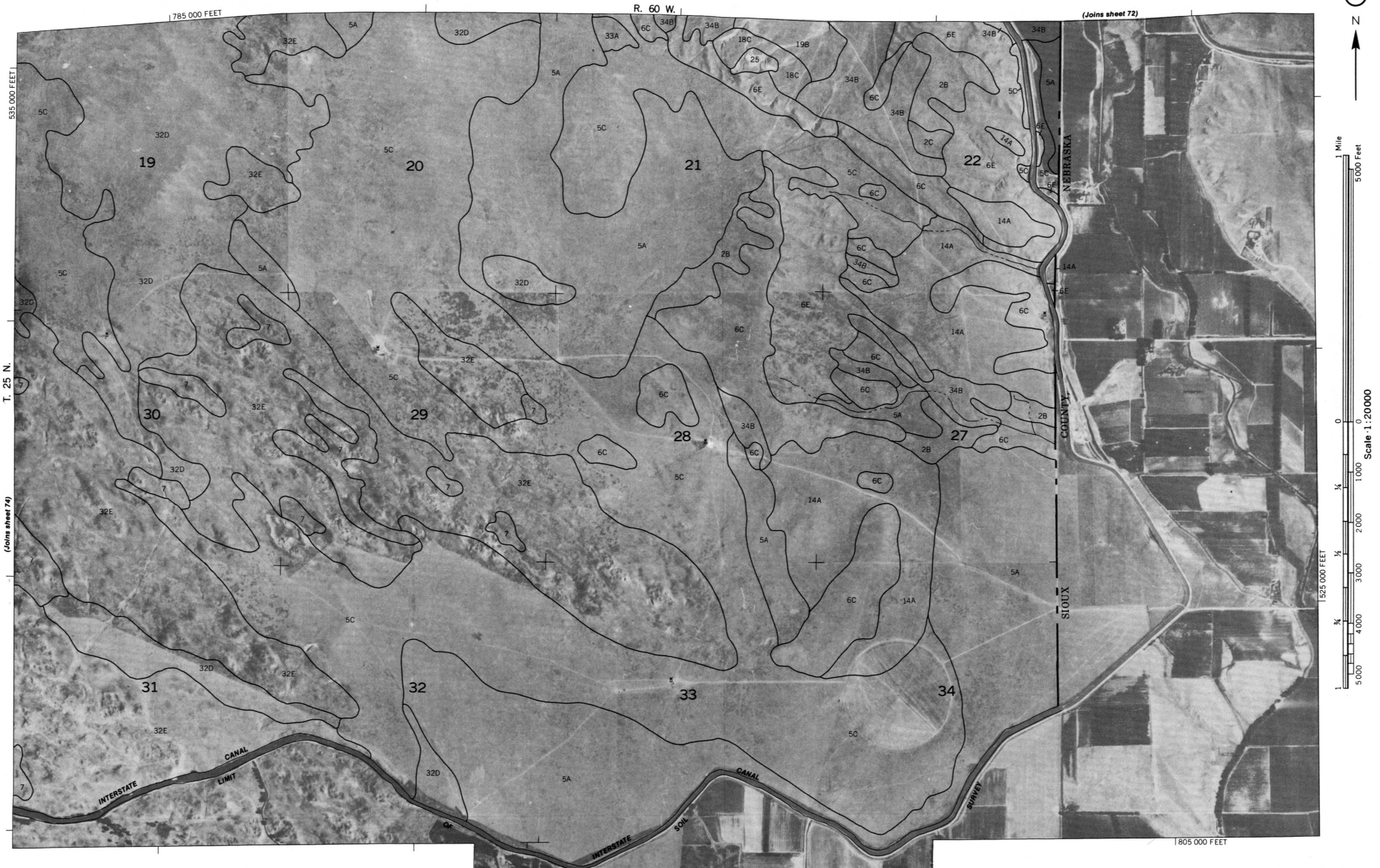
GOSHEN COUNTY, WYOMING, NORTH PART — SHEET NUMBER 74



This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Coordinate grid ticks and land division corners, if shown, are approximately positioned.

GOSHEN COUNTY, WYOMING, NORTH PART NO. 74

GOSHEN COUNTY, WYOMING, NORTHERN PART — SHEET NUMBER 75



GOSHEN COUNTY, WYOMING, NORTHERN PART NO. 75

This map is compiled on 1974 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Coordinate grid ticks and land division corners, if shown, are approximately positioned.